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The Influence of Faraday

TO-MORROW, Saturday, should be regarded by everybody interested in electrical science and engineering as a day above all other days.

It is a day for looking backward across a hundred years with wonder and with pride, to a place, near at hand in London, where a scientist of our own race, while modestly seeking truth, found something which was destined to eventuate in practical achievement yielding benefit and service to the whole human race. Does not the great marvel of such an event lie in the fact that one student persistently engaged in quiet research could so wondrously affect so much industrial history, and the lives of hundreds of millions of his fellows?

It was on August 29th, 1831—just one hundred years ago—that Michael Faraday made vital observations as the result of his experimental research in electro-magnetic induction. For that reason we have selected this week for the publication of Prof. E. W. Marchant's illustrated article, rather than wait for the time when all the excitement of the organised celebrations begins.

Whatever may be the attitude of the general public toward this great anniversary in the world of scientific research, that of the electrical engineer or student can only be one of admiration and veneration, because he understands from life at close quarters how quiet and unassuming laboratory experiments, and what appeared to be small inventions or discoveries, have proved to be the strong and widespread foundations of enormous industries. The entire electrical industry of the world is under debt to Faraday, and present probabilities are that it always will be so. As Dr. Marchant remarks, "Without his discovery there would be no electric power supply to-day."

The centenary celebrations are, of course, not merely a matter for electrical men. Innumerable other industries beside theirs are equally his debtors and due recognition of this fact is found in the preparations that have been made for next month.

Already, very appropriately, there has been much new literature and oratory regarding Faraday; the man; his research work; the effect of that work upon and in different industries; his character; his relations with other scientific men of his day, and so forth. Next month, however, when the organised celebrations take place in the presence of large numbers of distinguished visitors from all parts of the world there will doubtless be a fuller flow than ever of both written and spoken eulogium. Certainly the programme of arrangements provides such an opportunity.

Coinciding as the Faraday centenary does with that of the British Association, provision has been made for welcoming and entertaining in London an exceptionally large number of scientific men and women. There has been no gathering like it within our recollection unless it be that great and proud event of science—Lord Kelvin's jubilee of the Chair of Natural Philosophy at Glasgow University in the year 1896 for which the great ones came from the four corners of the earth to do homage to the king of kings among the living scientists. Then men gathered from far and

near to do honour to a living genius of world renown; soon they will assemble to mark the completion of one hundred years' achievement wrought through the work of one who passed away when most present-day electrical leaders were in their early childhood.

In the earlier volumes of this journal we devoted much attention to Michael Faraday and his work. Among the many contributions was an editorial article on the man, his work and his career, and his photograph was issued with every copy for July 15th, 1877. As this is unlike other photographs now circulating we reprint it on a large scale this week along with Prof. Marchant's article. It was taken in the year 1858 when Michael Faraday was 68 years of age. Four years after this he gave his last evening lecture at the Royal Institution. Later we wrote :—

"For 38 years he had been the life of the place (the Royal Institution). Week after week his simple eloquence, his apt illustrations, his thorough mastery of his subjects, had set London on fire with something of his own enthusiasm." . . . "Whatever might be the after-thought or the after-pursuit, each hearer for the time shared his zeal and his delight." . . . "But at last he found his memory failing, and the skill of his hand was passing from him, and touchingly and simply he bade his audience farewell. He waited on quietly until August 27th, 1867, when he died in his chair in his study."

Yet to-day, 64 years after his passing, the electrical and some other industries feel the beneficent influence of his work at almost every turn! We do well to remember that Faraday was as great, in his simplicity, as any man of science who has ever lived!

The National Situation

THE National developments that have taken place since the appearance of our last issue, have brought new hope to many over whose activities the continued uncertainty and growing depression were spreading a sort of creeping paralysis. The World has been watching, as usual, to see what Britain would do, and we trust that the good sense of our People generally will enable those who have shouldered the leadership in this crisis to guide the Nation through to Safety and Prosperity. May we for a time rise to that high plane where none is for the Party but all are for the State? It is important to bear in mind that nothing should come to a standstill. Rather is it a moment when everybody should do his or her utmost to keep things moving, even accelerating the rate of advance. The electrical and allied industries should least of all be adversely affected, for there is plenty of scope for electrical development, especially at this season of the year. "Economy!" will be the National Watchword—is not Economy one of the great merits of electricity?

Timely Counsel

WE wish to urge our readers to encourage as zealously as they can, at this particular economic pass in our national history, the purchase and consumption of electrical goods of British manufacture. Likewise, we would stress the importance of sustained electrical export trade activity, particularly of a publicity and propaganda nature.

German Manufacturing

REPORTS just to hand show that the turnover of the A.E.G. in the first ten months of the financial year 1930-31 indicates a decline as compared with this time last year. Naturally, the credit crisis has influenced business materially, interrupting the slight improvement which was in progress. Orders from public authorities in particular exhibit a decline, but orders from private undertakings have also fallen. Efforts to overcome the crisis by reducing costs of production and selling prices are being continued. Herr Carl von Siemens has stated that during the financial year the course of business in the high-voltage departments of the Siemens group has been very unsatisfactory. Orders have been so much down as compared with the previous year that the total turnover has failed to provide sufficient work for some factories to cover the costs of production. Herr Siemens says that the situation has not improved since the catastrophe of July 13th. On the other hand, in some of the low-voltage branches of the industry prospects are better, as by intensively working private and foreign business, some compensation has been obtained for the lack of State orders. Prices, however, are very unsatisfactory. Our report credits Herr Siemens with saying that the foreign trade in both branches has increased in volume, but diminished in value owing to the fall of prices throughout the world. Turning from direct manufacturing work to other interests, it may be noted that in the Lahmeyer group the company's tramway interests have experienced a falling off in traffic, while its electricity supply companies and its constructional department have all felt the effect of the unfavourable economic conditions. Lower dividends of associated companies are expected.

Electrical Engineering Production

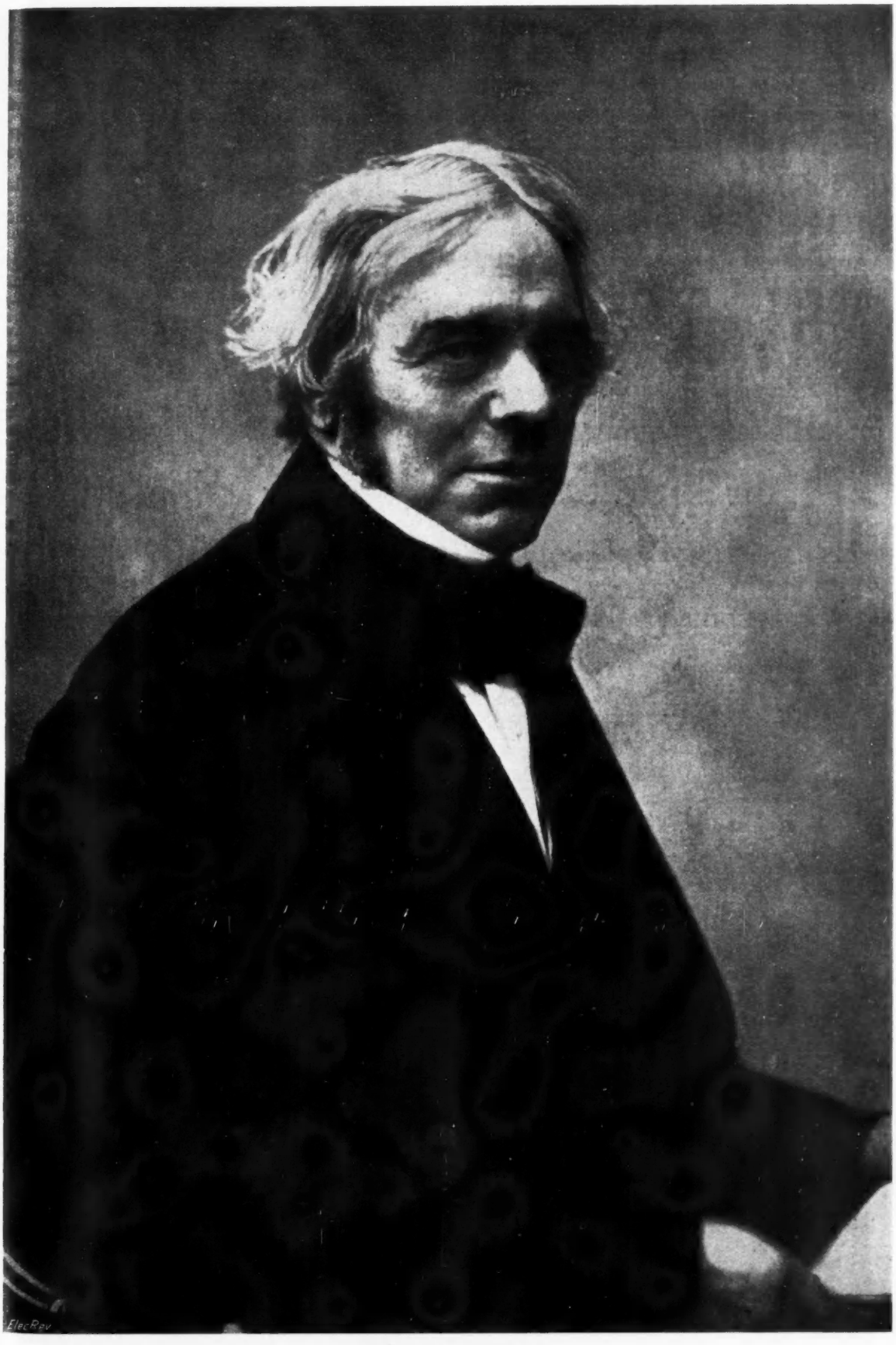
A SERIES of charts illustrating the course of trade, output, prices, &c., since 1924, form a supplement to the August *Ministry of Labour Gazette*. Among these are two dealing with the electrical engineering industry. The first is a curve showing production with the 1924 volume =100 as a basis, and from this it is seen that production commenced to decline in the second quarter of 1924, reaching the low level of 68.7 in the second quarter of 1925. It then rose, with one slight setback in 1926, to a peak of 131.1 in the third quarter of 1927. Another decline then set in, reaching its nadir (84.1) in the third quarter of 1928. A more gradual rise ensued until 116.4 was reached in the first quarter of 1930. Then the curve dropped again until it reached 82.0 in the second quarter of the current year. Although a period of less than eight years is perhaps too short to enable very sound conclusions to be drawn, a three-year cycle is discernible. The peak years were 1924, 1927 and 1930; the "valleys" occurred in 1925, 1928 and 1931. Are we too optimistic when we deduce that the lowest point has been reached this year and that we may now expect an upward movement of electrical production for the next eighteen months at least?

Telling Australia

THE Australian Association of British Manufacturers has sent us a copy of a little booklet which it has produced as a counterblast to American trade propaganda in Australia. It is entitled "One-Way Traffic" and is designed to demonstrate (and does so very clearly) that although Australia is a large purchaser of American products, the United States, by prohibitive duties and other means, keeps Australian goods out of the country. It is shown, on the other hand, that Great Britain is Australia's best customer, a good and sufficient reason why Australians should purchase British goods whenever possible. Thirty thousand copies of the booklet are being circulated in all the States of Australia, and particularly to selected members of the Federal Parliament. Other ways in which the Association has recently endeavoured to stimulate British trade in Australia have been a special effort in connection with an Empire Shopping Week and the exhibition of a specially-produced talking film.

Better Production

INSUFFICIENT emphasis is given in estimates for electrical installations, particularly heating, to the outstanding and exclusive advantages of electrical working—cleanliness, simplicity of application, instant response to operators' demands and, above all, ready and unique adaptability to automatic control. The resultant economy from the last-mentioned item often reduces the running costs from a non-competitive to a competitive figure, while the advantages as a whole always result in a better product, yet one sees comparative estimates based on bare fuel costs with no allowance, for the automatic-control factor or better production. There is certainly something of the "unknown quantity" about these points in connection with all new installations, and it therefore requires a little courage to bank on them, but conversion to electrical working has always resulted in superior produce, and automatic control has always reduced the bill; therefore experience should be reflected in the confidence of the estimator.



Michael Faraday
1791 - 1867

The above portrait is an enlarged copy of an actual photographic print which was issued with the ELECTRICAL REVIEW for July 15th, 1877. It was taken in 1858, when Faraday was in his 68th year. by Mr. E. J. Mayall, of Brighton.

Michael Faraday. By Prof. E. W. Marchant, D.Sc., M.I.E.E.

ON Wednesday, June 17th, 1891, at the Royal Institution, London, the Prince of Wales presided over a gathering which met there to hear a lecture* by Lord Rayleigh to celebrate the centenary of Faraday's birth. At that time the greatness of Faraday as a discoverer in chemistry and electricity was known all over the world. As Lord Rayleigh said, " . . . he maintained the renown of the Institution and the honour of England in the eyes of the civilised world . . ." but I do not think that anyone would at that time have prophesied that now, forty years later, when we are celebrating the centenary of his great discovery of electro-magnetic induction, such wonderful progress in its applications would have been made.

Of him it may be said as truly as of anyone "*Si monumentum requiris circumspice.*" One has only to look round in almost any part of England, or in almost any country in Europe, or America, to see the great towers which go "striding over the countryside" to carry electrical power and all the material benefits with which it provides mankind, to its most distant inhabitants. Huge power stations can now be seen all over the world for the supply of electrical energy, and they also are monuments to his genius, for without his discovery of electromagnetic induction the modern power station would never have come into being. He first showed us how electrical energy could be obtained from mechanical energy. The telephone is a direct result of Faraday's discovery, for it was only when Graham Bell used as a transmitter an iron diaphragm placed opposite to a magnet with a coil of wire round it, and set it in vibration by the human voice, that he obtained the currents needed to produce sound in similar apparatus used as a receiver.

Faraday in 1831

From a painting by H. W. Pickersgill, R.A. (By kind permission of the Royal Institution)

* See the ELECTRICAL REVIEW, June 19th, 1891, p. 787.

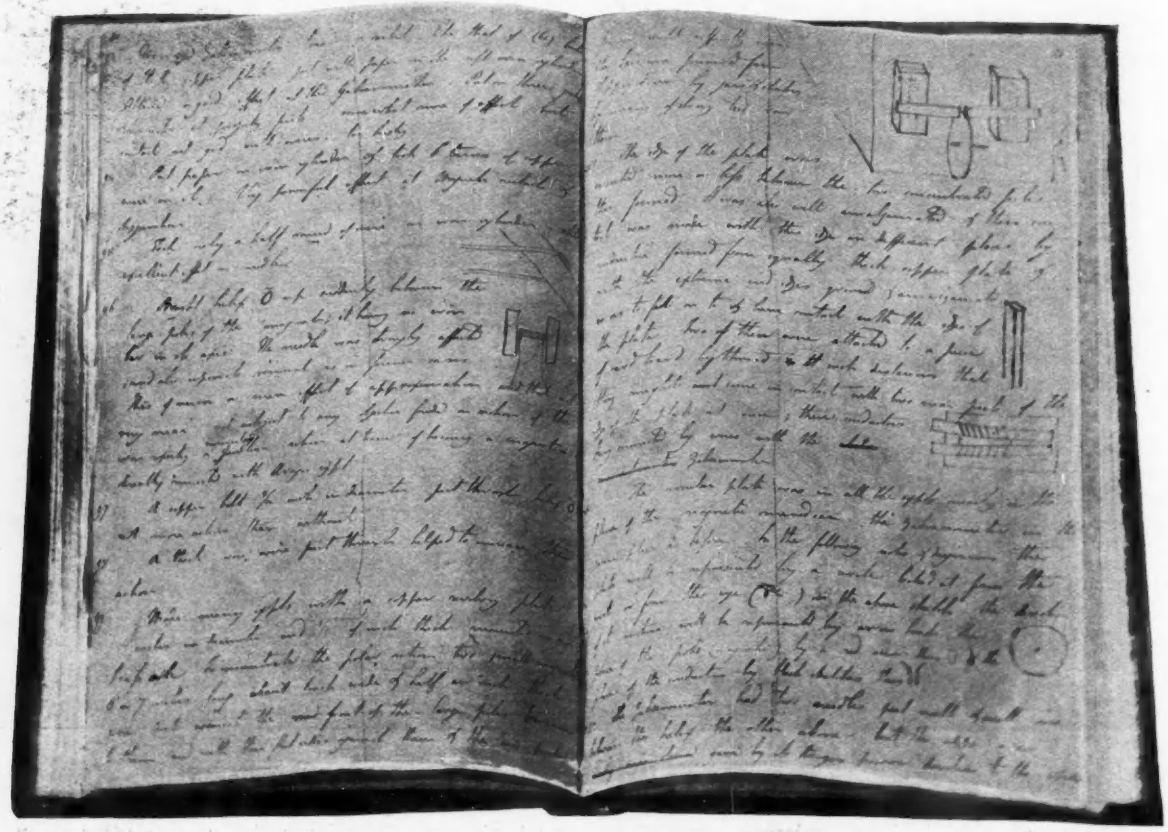
Early History

So many years have passed since Michael Faraday lived and died in London that it may be of interest to the present generation to know something of his early history.†

Mr. R. Appleyard, in his "Tribute to Michael Faraday," has endeavoured to trace some of his ancestors, and has discovered some particulars which throw light on the reason for his parents leaving Yorkshire and settling in London. It seems evident that the original house, Clapham Wood Hall, near Clapham in Yorkshire, in which his grandfather, John Faraday, lived, was converted by him into a cotton mill. Later it was called the "Bobbin Mill," which appears to show that the owners changed their trade from weaving to bobbin winding. There was a severe depression in the cotton industry at the end of the eighteenth century and the family migrated to London. Michael Faraday was the third son of James Faraday, a blacksmith, who married in 1786 Margaret Hastwell, a farmer's daughter of Mallestang, near Kirkby Stephen in Westmorland. Soon after their marriage his parents made their home at Newington, near what was once the village of Walworth, where their son Michael was born on September 22nd, 1791. The registers recording his birthplace were preserved, but recent inquiry has failed to identify the house where he was born.

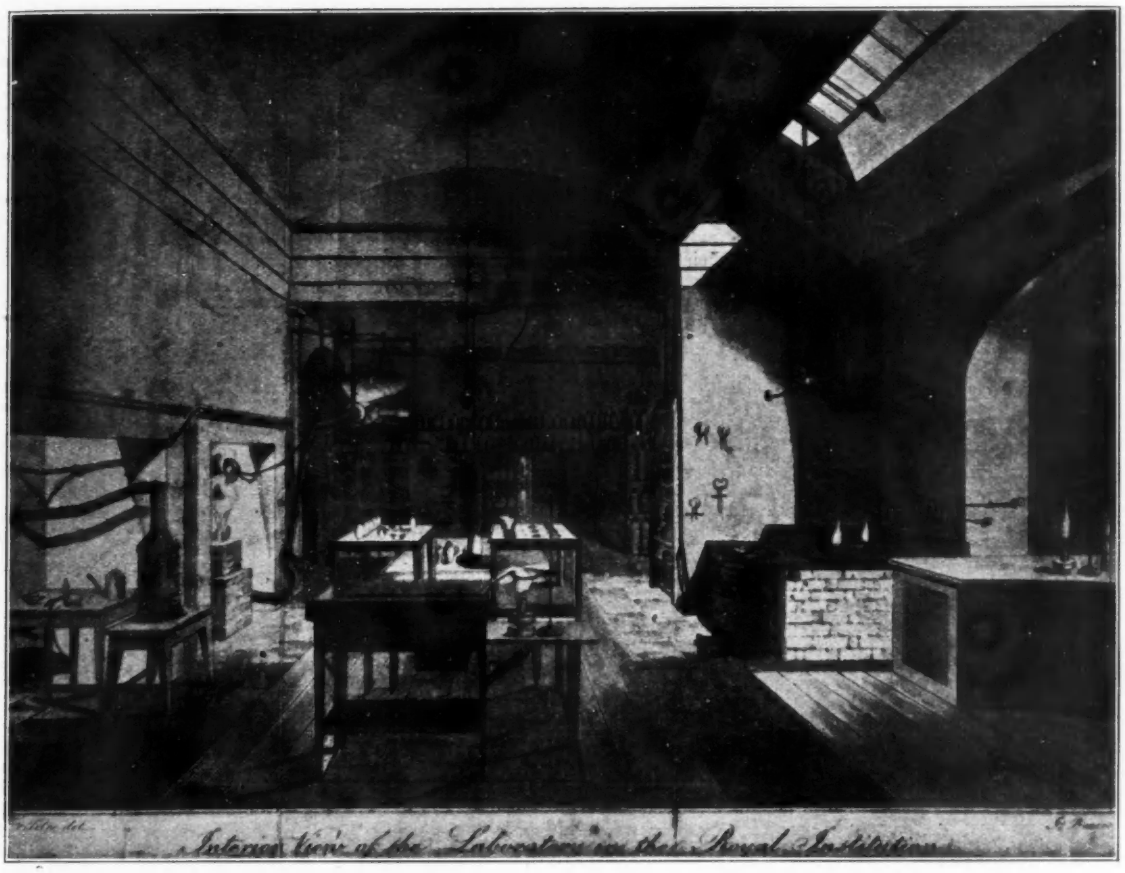
The family suffered considerable privations owing to the general distress prevailing during the French wars. In 1796 his father took his wife to Gilbert Street, where he obtained rooms over a coachhouse in Jacobs Well Mews, Manchester Square. Michael was then five years old and "found his play-

† I am greatly indebted to Mr. Rollo Appleyard, the author, and to Messrs. Constable, the publishers, of a "Tribute to Michael Faraday," for permission to quote from that volume many particulars regarding Faraday's early history.

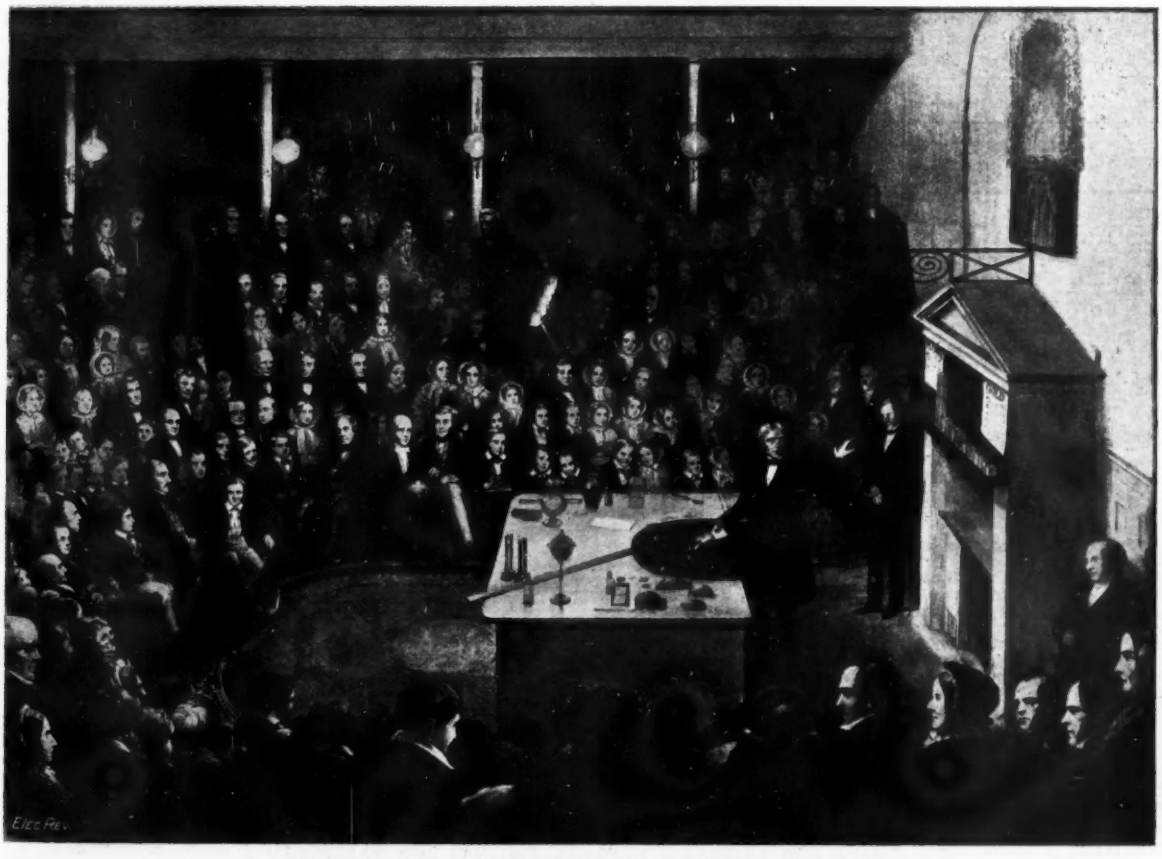


Faraday's Diary open at the page illustrating his First Dynamo

Photo by Henry Dixon & Son, Ltd. *By kind permission of the Royal Institution*



From a Drawing by W. Tite (By kind permission of the Royal Institution and of the "Post Office Electrical Engineers' Journal")

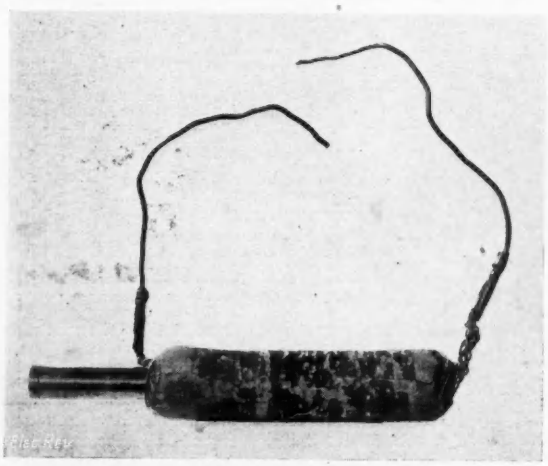


Faraday Lecturing at the Royal Institution on December 27th, 1855

By kind permission of the Royal Institution. From a painting by Alexander Blaikley. Photo by Henry Dixon & Son, Ltd.

ground in the streets in the neighbourhood of Spanish Place." Nothing is known of his early education, except that it consisted of little more than the rudiments of reading, writing, and arithmetic.

The Faraday family belonged to a body known as the "Sandemanians" whose founder was a certain John Glas,‡ who lived at Auchtermuchty in Fifeshire. He held peculiar views with regard to Church government, and with his son-in-law, Robert Sandeman, founded the sect which was called "Glasites," or "Sandemanians." The services of the Sandemanians resemble closely those of the Quakers, mutual exhortation being practised at their meetings. One of their tenets was that it was improper for any member of the sect to accumulate wealth, and each member considered his property liable to be called on to meet the wants of the poor, or the necessities of the Church. The connection of the Faraday family with this



The helix of copper wire and bar magnet used by Faraday to first demonstrate the production of an electric current: his most important experiment

sect may have been responsible for a good deal of the poverty from which it suffered, and it explains in some measure why Faraday was always unwilling to use his scientific knowledge for personal gain, preferring to give to the world freely the secrets he had won from nature. After leaving school he entered the employment of a Mr. Riebau, a bookseller at 2, Blandford Street, London, where he did his duties as errand-boy so promptly and so well that his master apprenticed him, without premium, to the trade of bookbinder.

‡ *Encyclopædia Britannica*: "Glasites."

Chemical and Electrical Studies

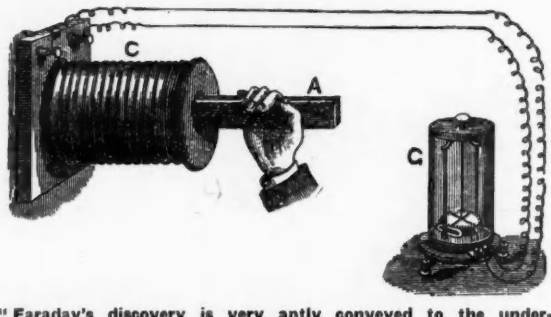
In 1809 the Faraday family removed to Weymouth Street, and on October 30th, 1810, Michael's father died. By that time he was beginning to read books as well as bind them, and thus he was introduced to the rudiments of chemistry and electricity.

In 1812 a Mr. Dance, one of the customers of the bookshop, found Michael Faraday studying an article on electricity in a book that he was binding, and gave him four tickets for some lectures by Sir Humphry Davy at the Royal Institution. Faraday took notes at those lectures and a little later when there was a vacancy at the Royal Institution for a laboratory assistant he sent them to Sir Humphry Davy, who was so impressed by them that he gave Michael Faraday the post at a salary of 25s. a week with two rooms, in which to live, at the top of the house. Although Faraday was intensely studious, he was neither dull nor ascetic. Mr. Appleyard quotes a letter that he wrote to a friend at that time . . . . "There is a grand party and dinner at the Jacques Hotel, which immediately faces the back of the Institution, and the music is so excellent that I cannot for the life of me help running, at every new piece they play, to the window to hear them."

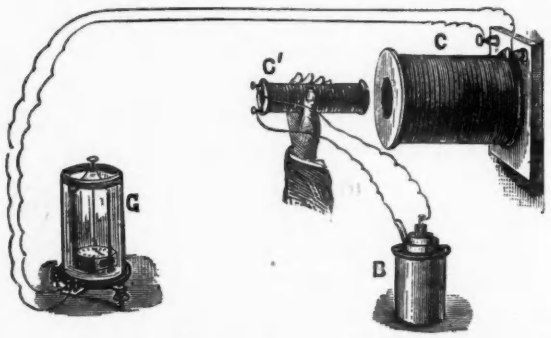
At that stage in his career an opportunity arose which enabled him to "graduate in the University of the World," for Sir Humphry Davy in 1813, accompanied by Lady Davy, started out on a Continental tour. Although Great Britain and France were at war at the time, they obtained a safe-conduct pass which enabled them to travel from London to Morlaix and then through Guingamp and Rennes to Paris. There Faraday met Ampere and examined the new substance "iodine." He gives a very vivid description of a visit of the Emperor and Empress to the Senate in full state, and also of the Chappé mechanical telegraph which was just coming into use in Paris. So impressed was he with Fontainebleau that he wrote a poem about it. After Paris they went to Lyons, Montpellier, and Nîmes, and the journal "describes Roman remains in such detail" as to indicate that if Faraday had not been a physicist "he would have been a very precise and illuminating antiquarian." Among other distinguished scientists he met were Gay Lussac, Bertholet, Cuvier, and Humboldt. In Milan he saw Volta, at that time an old man whom he describes as "an hale elderly man wearing the red ribbon, and very free in conversation."

He entered into the spirit of the carnival in Rome, for "he went in a domino to a masked ball where he found much amusement," and he especially enjoyed a visit to the City of Florence. The tour seems to have set him up in health and spirits, for he wrote to his mother shortly before his return to say that he was "heavier and thicker."

On his return, one of his first tasks was to put in order the mineralogical collection at the Royal Institution. He was also occupied in extracting sugar from beetroot and in making an



"Faraday's discovery is very aptly conveyed to the understanding by the following beautiful experiment:—If a bar magnet, A, is pushed into a coil C of insulated or covered wire, an electric current is generated if the circuit be closed, i.e., when the ends of the coil are joined together or, as shown, when they are connected with a galvanometer, the needle deflects, say towards the right; if the magnet be held stationary the current vanishes and the needle of the galvanometer returns to its normal position or zero; when the bar is withdrawn, another current is generated, but in an opposite direction to that of the first; the current again has but a momentary existence, and the galvanometer needle once more returns to its rest."



"If instead of the magnet we employ a second coil C¹, which will go loosely into the first coil C, and through which a current is permanently flowing from the galvanic cell B, similar effects will be produced in the orginal coil upon the insertion and withdrawal of the smaller one, to those observed in the case of the magnet."

Forty-five years ago the then Editor of the "Electrical Review," wrote a lengthy popular and humorous illustrated serial for this paper, entitled "The Strange History of a Dynamo." We extract from that story, which was subsequently published in booklet form, the above two diagrams with accompanying notes (from our issue of April 16th, 1886), regarding Faraday's experiments and the part that they fill in the story of the dynamo.

explosive chloride of nitrogen. When he was not busy with the Royal Institution laboratories, he was manufacturing rare chemicals, or performing analyses. He "squeezed chlorine into a liquid" and applied it successfully as a disinfectant when fever broke out in the Millbank penitentiary. At that time he was educating himself in "English composition, style, delivery, reading, oratory, grammar, pronunciation, and perspicuity," for he experienced great difficulty in presenting his ideas in proper sequence. . . . "I always find myself obliged, if any argument is of the least importance, to draw up a plan of it on paper and fill in the parts by recalling them to mind, and this done I have a series of major and minor heads in order, and from these I work out my matter." It is, of course, common knowledge that, later, at the Royal Institution, he proved a master of the art of exposition and drew audiences to his lectures such as had seldom been seen in England.

Early Lectures

One of his earliest lectures was at the City Philosophical Society on the "General Properties of Matter." Later he gave six further lectures and in 1817 his famous lecture on combustion. His standing in the scientific world was rising rapidly; the experience he had gained in lecturing and the severe schooling he had undergone in elocution brought their

The Unveiling of the Faraday Memorial at North Telephone Exchange, by Lord Kelvin, November 24th, 1906

(This photograph is reproduced from the "National Telephone Journal" of January, 1907)

1	Miss K. Barnard (Niece of Faraday)	13	J. Barnard (Nephew of Faraday)	28	A. P. Trotter	44	W. H. U. Napier	60	F. Woollard
2	Sir Joseph Swan	14	Dr. Walmsley	29	J. E. Kingsbury	45	W. D. Stewart	61	J. Poole
3	Sir A. K. Rollit	15	H. E. Harrison	30	A. Coleman	46	W. M. France	62	G. H. Bryan
4	Lady Kelvin	16	S. J. Goddard	31	W. M. Mordey	47	A. J. Aldridge	63	J. Ashton
5	Lord Kelvin	17	F. Gill	32	E. Laidlaw	48	O. S. Stiles	64	G. Maddock
6	Miss Barnard (Niece of Faraday)	18	C. Elliott	33	W. W. Cood	49	R. H. Williams	65	J. Wolff
7	H. Faraday (Nephew of Faraday)	19	H. Honor	34	J. F. Edmonds	50	J. R. Gall	66	H. S. Thompson
8	Sir R. T. Glazebrooke	20	J. Sandell	35	S. J. Smith	51	H. Bines	67	P. Prentice
9	Dr. Silvanus P. Thompson	21	C. B. Clay	36	H. Davis	52	B. S. Cohen	68	P. H. Cole
10	C. J. Phillips	22	F. C. Raphael	37	T. Fletcher	53	W. Ireland	69	H. Bruce
11	Miss Swan	23	I. H. Jenkins	38	H. C. Gray	54	A. Warner	70	T. W. Woodman
12	A. F. Blaikley	24	T. Mather	39	Dudley Stuart	55	J. H. Watkins	71	J. Ashton, junior.
		25	F. Francis	40	P. T. Wood	56	W. U. Lonnon	72	G. H. Bush
		26	H. Comer	41	W. Judd	57	N. McLeod	73	J. Teeboon
		27	W. Guy	42	Miss Hughes	58	G. F. Greenham	74	G. McGregor
				43	Miss Ashmead	59	C. T. Peacock		

own reward, for in 1820 he was an accomplished speaker. He was married in June, 1821, and set up home at the Royal Institution, though in 1823, still acting as Davy's chemical assistant, he had the misfortune to injure his eyes as the result of an explosion. He was elected a Fellow of the Royal Society in 1824 and in 1825 was appointed director of the laboratory under the Professor of Chemistry (Sir Humphry Davy), and in 1826 started the Friday evening discourses, which have since become famous, in the theatre of the Royal Institution. He was fond of entertaining friends at the Royal Institution, and after dinner they played like boys; sometimes he ran round the theatre of the Institution on a velocipede, which

ERECTED BY THE
STAFF OF THE
NATIONAL TELEPHONE COMPANY LIMITED.
TO COMMEMORATE THE FACT THAT
MICHAEL FARADAY USED TO WORSHIP HERE
FROM 1862 TILL THE DATE OF HIS DEATH IN 1867
FROM 1862 TO 1899 THIS BUILDING WAS
THE MEETING HOUSE OF THE SANDEMANIANS
OF WHICH BODY MICHAEL FARADAY WAS AN ELDER
THIS PLATE MARKS THE POSITION
WHICH HE USUALLY OCCUPIED ON THE PLATFORM
THE POSITION OF HIS PEW IS INDICATED BY
A PLATE ON THE FLOOR
UNVEILED BY THE
RIGHT HON. LORD KELVIN. O.M. P.C. G.C.V.O. F.R.S. L.L.D. &c.
24TH NOVEMBER 1906

A Memorial Tablet fitted in the Wall of the Switchroom of North Telephone Exchange, London

was then a new thing. Among artists Faraday appears to have been well acquainted with Turner, who consulted him about pigments. He never failed to see all the sights of the day and led a full and active life.

It is not possible in a short article to deal with the work which Faraday did in electro-chemistry and his study of the laws of electrolysis, or with his classical researches on dielectrics. It was Faraday who first explained the meaning of specific inductive capacity, and his theory of the polarisation of dielectrics is to-day generally accepted. His work on benzine and his chemical researches would fill another volume, but the experiments he made in 1831 with the hope of obtaining electricity from "ordinary magnetism" are the ones that we wish especially to recall to-day.

The experiments which led to the discovery of electro-magnetic induction are described in his "Experimental Researches"; they began with an investigation of the induction of electric currents. "Two coils of copper wire were wound on a cylinder of wood and prevented from touching each other by strong calico and twine." One was connected with a galvanometer, and the other "with a voltaic battery of 10 plates 4 in. square with double coppers and well charged," yet not the slightest sensible deflection of the galvanometer needle could be observed. "Next 203 ft. of copper wire in one length was coiled round a large block of wood, and another 203 ft. of similar wire was interposed as a spiral between the turns of the first coil, and metallic contact was prevented by twine. One of these helices was connected with a galvanometer and the other with a battery "of 100 pairs of plates 4 in. square with double coppers and well charged." Then he notes ". . . when the contact was made there was a sudden and very slight effect at the galvanometer, and there was also a slight effect when the contact with the battery was broken."

Induction Experiments

By that time he had begun to suspect that the action between the two coils was really due to the magnetism produced by the current flowing round one of them, so in his next experiments he used a welded ring of soft round bar iron, ⅞ in. thickness and 6 in. in external diameter. Three helices were wound round one part of the ring, each containing about 24 ft. of copper wire 1/20 in. thick. "They were insulated from the iron and each other in the manner already explained. On the other part of the ring about 60 ft. of similar copper wire in two pieces was applied in the same manner, forming a helix B. The helix B was connected by copper wires with a galvanometer 3 ft. from the ring. The helices A were connected end to end, so as to form one common helix, the extremities of which were connected with a battery of 10 pairs of plates 4 in. square." On August 29th, 1831, he noted that the galvanometer was immediately affected and "to a degree far beyond what has been described when, with a battery of tenfold power, helices without iron were used." Upon using the power of 100 pairs of plates with this ring "the impulse at the galvanometer when contact was broken was so great as to make the needle spin round rapidly four or five times before its motion was reduced to mere oscillations. By using charcoal at the ends of the B helix a minute spark could be seen when the contact of the battery with A was completed. The spark was rarely seen on breaking contact. A small platinum wire could not be ignited by this current, but there seems every reason to believe that the effect would be obtained by using a stronger original current, or a more powerful arrangement of helices."

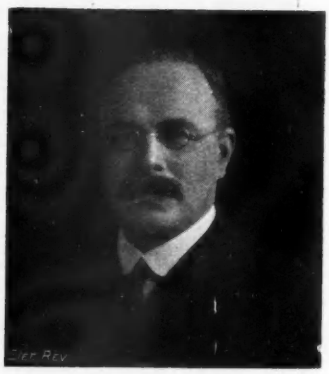
Another arrangement was then employed "connecting the former experiments on volta electric induction with the present," and this I think is the most important discovery that Faraday made.

The experiments with the iron ring had shown that the induction effect in one of the helices was probably due to magnetism, but it was only in the experiments described below that he showed that an electric current could be produced by a magnet. "The combination of helices was constructed upon a hollow cylinder of pasteboard. There were eight lengths of copper wire containing altogether 220 ft. Four of these helices were connected end to end, and then with the galvanometer; the other intervening four were also connected end to end, and a battery of 100 pairs of plates discharged through them. In this form the effect on the galvanometer was hardly sensible, though magnets could be made by the induced current. When a soft-iron cylinder ¾ in. thick and 12 in. long was introduced into the pasteboard tube, surrounded by the helices, then the induced current affected the galvanometer powerfully, and with all the phenomena just described." Then he goes on ". . . similar effects were then produced by ordinary magnets; thus, the hollow helix just described had all its helices connected with the galvanometer by two copper wires each 5 ft. in length. A soft-iron cylinder was introduced into its axis. A couple of bar magnets, each 24 in. long, were arranged with their opposite poles at one end in contact, so as to resemble a horse-shoe magnet, and then contact was made between the other poles and the ends of the iron cylinder, so as to convert it for a time into a magnet. By breaking magnetic contacts, or reversing them, the magnetism of the iron cylinder could be destroyed, or reversed, at pleasure. Upon making magnetic contact the needle was deflected . . . continuing the contact, the needle became indifferent and resumed its first position. On breaking contact again it was again affected, but in the opposite direction."

Later he proceeds ". . . as it might be supposed that it was by some peculiar effect taking place during the formation of the magnet, and not by its mere virtual approximation that the momentary induced current was excited."

Fundamental Experiment

The following experiment was made: ". . . all the similar ends of the compound hollow helix were bound together by copper wire, forming two general terminations, and these were connected with the galvanometer . . ." A cylindrical magnet ¾ in. in diameter and 8½ in. in length was used. "One end of this magnet was introduced into the axis of the helix and then, the galvanometer needle being stationary, the magnet was suddenly thrust in. Immediately the needle was deflected in the same direction, as if the magnet had been formed by either of the two preceding processes. Being left in, the galvanometer needle resumed its first position and then, the magnet being withdrawn, the needle was deflected in the opposite direction. . . . . By introducing and withdrawing the magnet so that the impulse each time should be added to those previously communicated to the needle, the latter could be made to vibrate through an arc of 180 degrees or more." That was the first alternator and *the* fundamental experiment, because it was then that Faraday first showed that an electric current could be produced by the motion of a magnet. In other words, by the interaction between a magnet and a coil of wire the mechanical energy used in moving the magnet could be transformed into the electrical energy developed by the coil.



Lafayette] [*Manchester*

E. W. Marchant, D.Sc., M.I.E.E., the Author of this Article, is David Jardine Professor of Electrical Engineering at Liverpool University

This is the principle on which practically all the electrical energy used to-day is generated. Many engineers have been engaged in the development of dynamo machines and alternators, and many of them who made great advances deserve recognition, but, primarily, dynamos and alternators depend on Faraday's experiments, and without his discovery there would be no electric power supply to-day. Nowadays nearly all the experiments he described are carried out in every physics laboratory and there is no difficulty in repeating them, because we now have all the apparatus required to carry them out easily, but it needed the genius of Faraday to visualise what happened when a magnet was thrust into a coil. It was he who first suggested lines of force, who was the first to present a picture of what might be assumed to be happening in the space surrounding a magnet, a picture which has been of incalculable value to all who have had to deal with magnets ever since. What would the electrical engineer do without lines of force? How could we picture magneto-electric induction without them? Faraday "filled in" the space surrounding a magnet. It was the medium that was the active cause in magnetic induction and, whether we believe in the ether or not, Faraday gave us something for which we can never adequately repay him.

When later in his life he became world-famous, he still showed the attitude of the true seeker after truth. In the preface to his "Experimental Researches" he says ". . . other parts of these researches have received the honour of critical attention from various philosophers, to all of whom I am obliged . . . and, although I cannot honestly say that I wish to be found in error, yet I do fervently hope that the progress of science in the hands of its many zealous cultivators will be such as will even . . . make me think that what is written and illustrated in these experimental researches belongs to the bye-gone paths of science."

Such was his modesty in his achievements. His fame is now established, and he will never be forgotten so long as science is studied by mankind. We have in him as good a model of the scientific investigator as we may ever hope to see; a skilful experimenter with a genius for observation, and for the interpretation of the results of his experiments; always seeking new truths, not greatly concerned with their practical applications, wholly oblivious of their financial value, but always anxious to probe further into the secrets of nature. Withal, a man of simple life, of simple yet courtly manners, of simple faith, a man as great in his simplicity as any man of science who has ever lived.

Faraday Centenary Notes

WE have pleasure in acknowledging our indebtedness to the Royal Institution for kind permission to reproduce some of the pictures appearing in the preceding pages; also to the *Post Office Electrical Engineers' Journal* for lending illustrations which appeared in the July, 1931, issue of that journal, in an article from the pen of Mr. Andrew Gibbon.

Advance Survey of Events

The final programme will be available within the next three weeks, but advance information is that the celebrations will include the following arrangements:—

September 19th and 20th.—The reception room at the Royal Institution will be open both days to delegates and guests.

September 21st.—Visits to places of interest in London. *Afternoon.*—Reception of delegates by the President and Managers of the Royal Institution in the Lecture Theatre. *Evening.*—The Faraday Commemorative Meeting at the Queen's Hall, Langham Place, W.1; short speeches by representatives of institutions in various parts of the world to be broadcast.

September 22nd.—*Morning.*—I.E.E. Conference at Kingsway Hall, W.C.2. *Evening.*—Conversazione at the Royal Institution; conversazione of I.E.E. at Royal Albert Hall.

September 23rd.—Private view of the Faraday Exhibition at Royal Albert Hall. *Afternoon.*—British Association Centenary meeting at Royal Albert Hall. Opening of the Faraday Exhibition to the public by the Rt. Hon. J. C. Smuts, C.H., F.R.S., President of the British Association. *Evening.*—Presidential address to British Association.

September 24th.—*Afternoon.*—Garden party at the National Physical Laboratory, by invitation of Sir Joseph Petavel, K.B.E., F.R.S., Director of the Laboratory. *Evening.*—Soirée at the Royal Society, Burlington House, by invitation of Sir Frederick Gowland Hopkins, President, and the Council of the Royal Society.

September 25th.—*Evening.*—Dinner given at Dorchester Hotel, Park Lane, W., to representative delegates and guests by H.M. Government.

The Faraday Exhibition

The Centenary Exhibition, to be held at the Royal Albert Hall from September 22nd to October 3rd, is being organised by the Institution of Electrical Engineers, which will be responsible for its cost, in co-operation with the Central Electricity Board and the leading associations in the electrical and chemical industries. The exhibits are being designed to demonstrate in a novel and practical manner the benefits to the human race that are due to Faraday's discoveries.

The central feature of the exhibition will be showcases containing Faraday's personal relics, and reproductions of his more important experiments are being arranged by the Royal Institution, where Faraday lived and worked.

Members of the Institution of Electrical Engineers, delegates to the centenary meetings, and those taking part in the meetings of the British Association will have opportunities of viewing the show privately during the I.E.E. conversazione as well as on the morning after.

The British Association

By a happy coincidence, the hundredth anniversary of the foundation of the British Association for the Advancement of Science also occurs this year. Its first meeting was held about a month after Faraday's culminating discovery, and it is therefore appropriate in every way that the presidential address should be delivered on September 23rd during the general tribute to the work of the great pioneer. The president of the Engineering Section, Sir Alfred Ewing, F.R.S., has chosen "Power" as his subject, and papers on special aspects of Faraday's work will be given before the Section. Brig.-Gen. Sir Harold Hartley, C.B.E., F.R.S., president of the Chemistry Section, will speak on "Michael Faraday and the Theory of Electrolytic Conduction."

The Magneto-Electric Spark

In this journal on July 15th, 1877, we said:—

"On February 8th, 1832, Faraday obtained for the first time the magneto-electric spark, an experiment which inspired Herbert Mayo with the following impromptu:—

"Around the magnet, Faraday
Was sure that Volta's lightnings play:
But how to draw them from the wire?
He drew a lesson from the heart;
'Tis when we meet, 'tis when we part,
Breaks forth the electric fire."

The Centenary of 1891

Lord Rayleigh, in his lecture delivered at the Royal Institution in honour of the centenary of the birth of Faraday, on June 17th, 1891, said:—

"Fired by contact with the genius of Davy, he volunteered his services in the laboratory of the Institution. Davy, struck with the enthusiasm of the youth, gave him the desired opportunity, and secured in Faraday not the least of his discoveries."

The early promise was indeed amply fulfilled. The following further references are quoted from this journal: "and for a long period of years, by his discoveries in chemistry and electricity, Faraday maintained the renown of the Royal Institution, and the honour of England in the eyes of the civilised world."

Faraday, said Lord Rayleigh, made his discovery by such methods as were available to him—he could not call in aid the elaborate resources of modern science. With all his skill he did not light upon the truth without great delay and difficulty. In December, 1824, he had attempted to obtain an electric current by means of a magnet, and on three occasions he had made elaborate, but unsuccessful attempts to produce a current in one wire by means of a current in another wire, or by a magnet. He still persevered, and on August 29th, 1831, he obtained the first evidence that an electric current could induce another in a different circuit.

Lord Kelvin's Tribute in 1891

Lord Kelvin (then Sir William Thomson) said that the splendid results of Faraday's labours contributed in no small degree to the scientific glory of the nineteenth century and helped to make it one of the most prolific periods in the world's history. Faraday was throughout animated solely by the love of knowledge. He freely gave his discoveries to mankind, and left it to others to turn them to practical and profitable account.

The Design of Electric Fires. By W. K. Fleming

Some points of view from a supply engineer

IT may not be seasonable at the present time to discuss electric fires, but, just as much of the work of Christmas annuals is done during the summer-time, so do our electric fire manufacturers in the summer months evolve new designs and prepare the programme generally for the winter season.

I have written the following notes from practical experience as one dealing with the consumer on one hand and the fire suppliers on the other. From this point of view, I hope that some of the remarks may prove to be a little helpful to manufacturers. They are ventilated at this time so that any point of practical use to them may be utilised before the new fire season starts.

Certain of the points raised in these notes may seem trivial and unimportant, but it is surprising how some small defect in the design or equipment of a fire can cause annoyance, dissatisfaction, and expense, either to the consumer or to the retailer. If one considers such an experience multiplied some thousands of times by the number of fires sold, then if the trouble can be lessened or overcome by improvements, it is all to the good of everybody concerned.

I think manufacturers should not decide that a fire is necessarily more or less perfect because it has been on the market for some time, is a good seller, and brings no complaints from retailers. Many of us buy fires and other appliances, and while observing some point that could be improved upon, hesitate to criticise a manufacturer's standard article, beyond making some reference to a travelling representative. Others of us just buy fires and send them out without much consideration of details. I should like to say, however, that whenever I have had occasion to communicate with manufacturers regarding points of design, &c., my observations have been received most courteously, and in several instances suggestions have been carried out.

The Danger of Cheapness

There is a pronounced tendency to flood the market with cheap electric fires. The effort on the part of fire manufacturers to bring down the cost of electric fires is to be desired, and there are many cases of prices being reduced without impairing the original good quality and workmanship. But it is questionable whether the immense range of cheap and indifferent-looking fires is a good thing for the industry. When a consumer has wanted a low-priced fire I have never found any difficulty in selling a good substantially-built fire in competition with some cheap flimsy thing. Supply authorities are expected by consumers to set a standard in the apparatus they offer, and the confidence of consumers in this as in other matters is a thing to guard and respect.

We want well-built fires that will last and keep their finish; fires that are safe and efficient; fires designed for easy wiring and replacements. The urge for cheapness often results in these essentials being neglected. Let us look at one or two examples.

A small cast-iron fire was recently produced. It is of robust construction and efficient, but the carrying handle is part of the cast metal of the fire body. It is a portable fire which may be moved about frequently, but when it is switched on, the handle becomes so hot that it cannot be touched. Fingers get burnt, and the estimation of electric fires in some consumer's mind does not remain so high as it was.

The flexible cable for a certain bowl fire passes through a hole in the cast-iron base. If it is desired to disconnect this, say, for fitting a longer flexible, the whole fire must be completely dismantled—base, element, reflector and guard. Otherwise it is a very good bowl fire, and could just as easily be sold with a better form of connection with the addition of another one or two shillings to the price.

A fire which I regard as positively dangerous is that type of upright fire which is left quite open at the bottom. It is possible, in moving the fire, for the exposed connections to come into contact with some metal projection about the fireplace. The natural curiosity of children may also lead them to place a hand underneath and touch live terminals. This could happen in certain cases even if the fire was switched off, for there are still fires being sold which are controlled by switches for each element.

I suppose most of us have met the kind of fire with a sheet metal back, which, screwed on to the cast metal body, springs when it is taken off and refuses to be screwed on again without much laborious manipulation. Sometimes the visible evidence of drawn holes in the sheet metal back shows that even the fitter in the erecting shop had his troubles before he finally got it jammed on.

When buying electric fires, the inside of the fire is just as interesting to me as the outside. It is there that you will find differences in detail, differences in fitting, quality, and workmanship that often surprise and astonish. The hall mark of a good fire is always to be found inside.

Fire Connections and Flexibles

On the subject of fire connections, it is surprising how casual are some of the methods employed. Often a hole in the bottom with an insulated bush is all that is provided, leaving the flexible to pass inside. Eventually the rubber cores within become dry and crack with the intense heat, or a sudden strain is imposed on the flexible, breaking one or two of the cores at the connection bolts. A knot on the flexible to meet the second contingency is a clumsy makeshift. Undoubtedly the best method of terminating the flexible is in a well-designed insulated terminal block at the base outside the fire, with provision for a cord grip, and an earthing terminal to be used if desired.

There is a remarkable variety of opinion on the part of fire manufacturers as to what kind of flexible should be supplied with an electric fire. Apart from varieties in the size of conductors, one finds fires supplied with twin-twisted, twin-circular, and triple-circular flexible. Even on the question of the colour of the flexible, there are some peculiar ideas. The writer could never understand why one firm making excellent fires elected to send them out, no matter what the finish, with light blue flexible. Apart from the tendency to get dirty more quickly, it is not a colour to harmonise with most fires and rooms.

Electric fires would be better supplied without flexibles, for then when they are eventually sold to consumers, the right colour, length, and sizes can be fitted, using two-core or three-core according to whether the connection is by two- or three-pin plugs.

Very frequently the flexibles supplied with fires have to be scrapped because they are too short. This is particularly so with bowl fires, where the standard length is six feet, with a bayonet cap adaptor fitted. The futility of this is self-evident, as in many cases the flexible will not even reach to the lamp-holder. Bowl fires, too, would be better supplied without adaptors, as they have often to be connected to heating circuits by plugs, and time is spent disconnecting the adaptors, which often get thrown aside. Manufacturers may say that fires can be supplied with any length and type of flexible desired, but most fires are bought for stock and show, and the conditions under which they are to be used are not known until they are sold.

Electric Fires—or Electric Fireplaces?

The portability of the electric fire is a great asset, and, quite rightly, we stress this in our sales arguments to consumers.

We appear to have decided, however, that *all* electric fires must be portable. Most of the larger types of electric fires, which are never intended to be moved, are just self-contained pieces of heating equipment to be placed down in front of a fireplace.

A consumer often desires a fire fitted to complete, and harmonise with, an existing fireplace, and the question of portability does not arise. In cases of this kind, no matter how well-designed the self-contained electric fire may be, it seldom gives the finished fireside appearance merely to place such a fire in position, even with some kind of screen behind. Installations have been observed where the grate was removed and the back of the fireplace completely re-tiled. This is an expensive undertaking, and only certain types of electric fire could be used to justify doing it. There are thousands of ordinary householders each year changing from coal to gas or electric fires. In one of the public rooms at least most of them want the existing coal fireplace converted to the modern way quickly, attractively, and at a reasonable cost. What have we to offer them? A whole host of portable and semi-portable electric fires for dumping down in the fireplace.

Learning from the Gas Industry

Our competitors, the gas industry, easily overshadow us in the design and fitting of gas fires to existing fireplaces. One can choose a gas fire, with metal back plate and base plate to any size required and in the same finish as the fire. The back plate is sometimes just big enough to cover the metal work of the old fireplace. More often it covers the complete existing tile surround as well, and then the new fire with the fitted metal back and base gives quite a new and improved appearance to the fireplace.

I have inspected many recent gas-fire installations of this kind, and have been compelled to express admiration for their artistic design and appearance. The price is reasonable, for these metal surround plates in a particularly pleasing sprayed glossy finish only cost ninepence per square foot. If rumour is correct, the value and appearance of these gas fires will shortly be further enhanced by the introduction of a new adjustable tiled surround.

The gas industry, of course, has specialised in this work, as its fires must of necessity be fixed. There is no reason, however, why we should not have competitive arrangements for this application of the electric fire. The plain fact is that most types of electric fire available are of a portable nature and unsuited for this work from the point of view of design and appearance. It is no use saying that something can be supplied specially to order; the gas industry already has it listed as a standard arrangement which the prospective consumer can choose at a moment's notice. The competition has to be met and dealt with on the spot.

We are losing business through this too-slavish adherence to portability, and the sooner we rectify it the better.

New Ideas

To my mind there were two outstanding features in the electric fires exhibited at the I.M.E.A. exhibition at Scarborough last June. One was the new development in the ordinary flat fireclay firebar which has the effect of giving a uniform glow over the whole surface of the bar. This is a radical departure from existing practice, and I believe it will prove a contribution of great importance to electric fire design.

The other feature was the new type of imitation coal fire exhibited by one manufacturer. This fire has the most natural appearance of a partly burned-down fire with red hot glowing coals. Here again a complete departure has been made from the usual flickering imitation coal fire. With the exception of one or two outstanding designs, most of these fires at present look painfully like imitations and nothing else. The new fire mentioned is a bold and ingenious effort to introduce something new and realistic. I have one little criticism to make arising from the brief inspection during its preliminary show at the exhibition. In one model at least the electric heating elements are far too prominent, and detract from the almost perfect illusion of the imitation part. The general design of this particular model is otherwise excellent, and the appearance and value of the fire would be much enhanced if the electrical heating part could be re-designed somewhat.

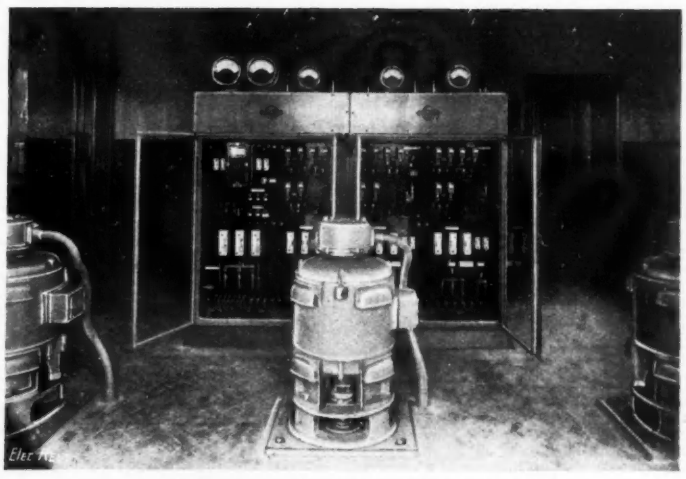
There was real original thought behind both of these innovations. After all, why should we follow along the same grooves year after year? The trend in electric fire design has been to take a firebar—the same firebar for years—and reclothe it in various shapes, designs, and finishes of iron, copper, brass, and other metals.

I believe that many of us are so deeply engaged in one branch or other of our industry with the immediate and pressing needs of the moment that we often forget what a wonderful thing electricity is. We should remember that to set out and try and change or improve some application in which electricity is used is like some great adventure with infinite and entrancing possibilities. Almost from the beginning, the great inherent advantages of electricity have set us on a good part of the way towards achieving something.

Modern Sewage Disposal By C. H. S. Tupholme

Completely automatic control of operation takes care of all conditions

THERE has recently been put into operation one of the most up-to-date sewage schemes in the world, that of the Rothwell Urban District Council, in which electric control automatically adjusts the pumping and other plant to meet any conditions. Sewage is collected from two separate drainage areas by two main intercepting sewers, each terminating at a pumping station (Oulton and Fleet Bridge) where the sewage is lifted to the outfall works at Lemon Royd, through two 18-in. rising mains about 1,570 and 330 yards long, respectively. In each station are three Pulsometer pumps, each capable of lifting 50,000 gal. of sewage per hour. Two pumps at Oulton are capable of pumping the maximum hourly flow from Rothwell and Oulton in 50 minutes, and at Fleet Bridge two pumps can raise the maximum hourly flow and trade waste from Woodlesford in 10 minutes. In each case a third pump is in reserve, but at Fleet Bridge the reserve pump may come into action during wet weather if the two other pumps fail to deal with the sewage in the required time, and will pump storm water through a separate 12-in. rising main to storm tanks.



Pump Motors and Control Gear at Fleet Bridge

The pumps are each driven by a separate 20-b.h.p. electric motor fixed at the floor level, vertically above the pump, the current both for power and lighting being supplied by the Yorkshire Electric Power Co. The motor control apparatus is duplicated at both stations, but the whole is under the supervisory control of a central regulating and recording station. The storm-water pump at Oulton is, however, separately installed and manually controlled. The pumps at Oulton are arranged to work for 50 minutes out of each hour, leaving the Fleet Bridge station to be operated for the remaining ten minutes, and this disposition is automatically regulated by the master clock at the central control station.

At each station there is a float-operated master switch which automatically shuts down or re-starts the pump motors according to the rise or fall of the well level. In order to provide for possible alterations in the rate of flow, the scheme allows for adjustments to be made in the relative periods through which the two stations will work, but the dual cycle will remain at one hour in all.

The engineer-in-charge at the central station can cut out the time-switch control and actuate the motor control panels at either station by a hand switch at times of flood. The capacity of the disposal works to deal with the inflow remains safeguarded as the transfer switch is arranged so that it is only possible to work one pumping station at a time. If the Oulton station were under normal conditions and it suddenly became necessary to deal with storm flow at Fleet Bridge, the engineer would move the transfer switch to "Fleet Bridge Pumping."

The master control clock is fitted with a dial making one revolution per hour against a fixed pointer, indicating minutes past the hour, and the pilot control circuits are switched by two arms, one for each station, these being actuated in succession as the face of the clock revolves. The contacts may be suitably adjusted to vary the time between opening and closing the master circuit regulating each station, but there is a definite interlock between the two arms which prevents more than one station operating at the same time. A try-out switch will cut out the master time switch in an emergency and leave the pumps under the control of the float switches only.

Throughout the respective period which the master clock allocates to each station, the two motors in the cases of Oulton, and the three motors at Fleet Bridge are automatically stopped or started, according to the position of the float switches governed by the level in the pumpwell. The whole scheme may be left day and night to the completely automatic control of the master clock, but at any time the control may be taken over by the engineer or the attendant.

The engineers responsible for the scheme are Messrs. Willcox and Raikes, M.M.Inst.C.E., and the resident engineer is Mr. J. G. Whitfield. The general contractors for the works were Provincial Construction Co., Ltd., and the sub-contractors were: pumping plant, the Pulsometer Engineering Co., Ltd.; automatic control, the Igranic Electric Co., Ltd.; sewage distributors, Adams-Hydraulics, Ltd.; meters and recorders, George Kent, Ltd.; electric cables, Callender's Cable and Construction Co., Ltd.

The Application of Induction Regulators. By V. C. Bryan

Apparatus which is not so generally understood, either in theory or in application, as it should be

THERE is a tendency to-day for the load on distribution networks to increase steadily, both in density and also in its area of application. This tendency is being met on the generating side by the interconnection of one power station to another. On the distribution side new development is being catered for by the greater use of high-voltage feeders in place of heavy-current distributors.

The efficiency of interconnectors and the regulation control of feeders can, under certain circumstances, be considerably improved by the use of induction regulators, the function of which is very gradually to control the voltage or power factor of the circuits to which they are connected. Three types are available: (i) the 3-phase single-wound, (ii) the 3-phase double-wound, and (iii) the single-phase. Their individual characteristics are quite distinct, but the principle of their operation is one and the same.

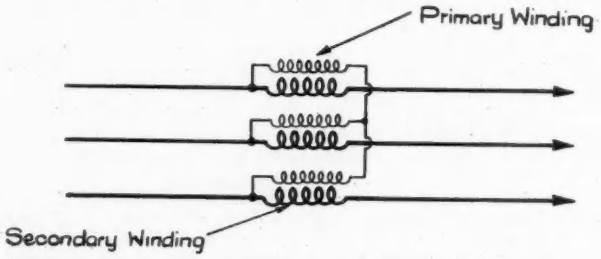
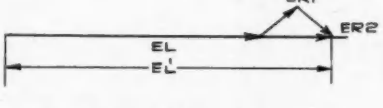


Fig. 1.—Diagrammatic Representation of Induction Regulator

The induction regulator is essentially a polyphase transformer with a movable primary winding. It has two windings—a primary one connected in shunt and a secondary one in series with the line, as shown diagrammatically in fig. 1. Since the secondary winding of the regulator is in series with the main circuit to which it is connected, any pressure induced in the secondary windings by the primary must be added to, or subtracted from, the main-line pressure. If provision is made for varying the voltage induced in the secondary windings, or for changing their phase relation with respect to the main-line voltage, the latter voltage can be raised, or lowered, by an amount equal to the secondary pressure of the regulator. The control of the pressure induced in the secondary winding of an induction regulator is obtained by moving the primary winding in relation to the secondary winding in such a manner that the value of flux embracing the two windings is changed. These changes then alter the magnitude, or direction, of the secondary voltage and enable it to add to, or subtract from, the line voltage as desired.

The usual construction of regulator is very similar to that of an induction motor in a standstill position. Whichever winding proves most convenient is placed upon the rotor, and the other winding is placed upon the stator. The rotor can be rotated by means of a worm wheel drive, so that the primary and secondary windings may take up any desired positions relative to one another, with the result that the amount of flux embracing both primary and secondary windings is varied.



EL = Line Pressure
ER1 = First Regulator Pressure
ER2 = Second Regulator Pressure
E'L = Total Pressure

EL = Line Pressure
ER = Regulator Pressure
E'L = Total Pressure

Figs. 3 and 4.—Three-ph. Double and Single-ph. Regulator Vectors

Three-phase Single Regulator

The three-phase, single-wound regulator has a 3-phase primary winding which sets up a rotating flux that produces a constant voltage in the secondary winding, whatever position the latter may occupy. The voltage of the line to be controlled is then varied, due to the fact that the secondary voltage remains constant, but changes its power factor with different positions of the regulator. The secondary voltage then adds on vectorially to the line voltage, as shown in fig. 2. It will be noticed that the line voltage is, as a result, changed with regard to its phase relation with the line current, which latter characteristic is, under certain circumstances, a disadvantage.

When the secondary and primary voltages are in phase the maximum increase in line voltage is obtained. When the secondary voltage is so moved in position as to bring it exactly opposite to that of the primary voltage, the secondary voltage subtracts from the line voltage, and the lowest position is obtained. Intermediate positions of the regulator give intermediate values of buck and boost, as shown in fig. 2.

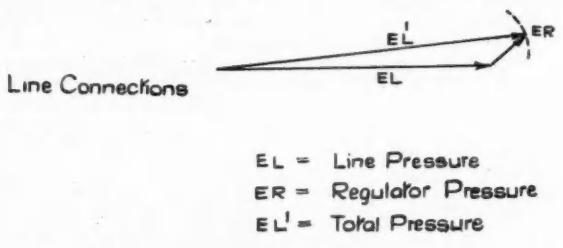


Fig. 2.—Vectors for 3-ph. Single Regulator

Three-phase Double Regulator

The 3-phase double-wound regulator is specially designed to overcome the phase displacement produced by the single-wound regulator. It comprises two single-wound regulators of half the capacity of the one single-wound regulator they are intended to replace. They are connected together with their primary windings in parallel and their secondary windings in series with one another and the main line.

The voltage induced in the secondary of the one regulator is arranged to be opposite as regards phase relation to the other. This is effected by turning the moving portions of the two regulators in opposite directions, or by winding the regulators themselves in opposition. The result of this procedure is shown vectorially in fig. 3, from which it can be seen that the two half voltages add on to the line voltage without affecting the power factor.

This type of regulator has the very useful characteristic of possessing a zero boost position. When the regulators are in the position of zero boost, the voltage induced in the secondary of one is exactly equal and opposite to the voltage induced in the secondary of the other. This allows the regulator to be short-circuited and enables it to be inserted and withdrawn from operation in the main line and isolated without the use of elaborate switching arrangements.

Single-phase Regulator

The single-phase regulator is used as a polyphase bank upon a 3-phase system, and is very similar in effect to the 3-phase double-wound regulator described above. It adds, or subtracts, its secondary voltage without introducing any phase displacement, and also has a position of zero boost. In addition, by virtue of the fact that three separate units are used (one for each phase), it enables individual control of each line to be obtained, which is an advantage under certain circumstances.

The principle of operation is, however, somewhat different to that of the polyphase regulators already considered, since the primary winding is only a single-phase one, which does not produce a constant rotating field. The movement of one winding with regard to another is therefore accompanied by a change in voltage, but the power factor remains unchanged. This condition is shown vectorially in fig. 4.

The secondary induced voltage is added to the line voltage without introducing any change in the power factor. When the secondary winding is in the position of no boost, it has no voltage induced into it. Under these circumstances the secondary current is liable to produce a heavy flux, which increases the secondary reactance considerably. This difficulty is generally overcome by the provision of a short-circuited quadrature winding, which maintains the reactance of the secondary winding almost constant under all conditions.

A Rheumatism Clinic

The establishment recently opened in London for the benefit of the L.G.O.C. employès has been very fully equipped with modern electro-medical apparatus of all sorts

RHEUMATISM in its various forms, acute and chronic, is one of the most insidious and relentless diseases. It is one of the main causes of industrial invalidity, its prevalence and the cost of the working time lost thereby annually not being generally appreciated. The predisposing causes are numerous and need special attention, a frequent focus of infection being the teeth and gums.

The disease is best attacked by physical, not chemical, treatment known as physiotherapy. The agents used are heat, light, electricity, and water (hydrotherapy and balneology); massage combined with movement and manipulation is also beneficial, and relief often follows bowel irrigation.

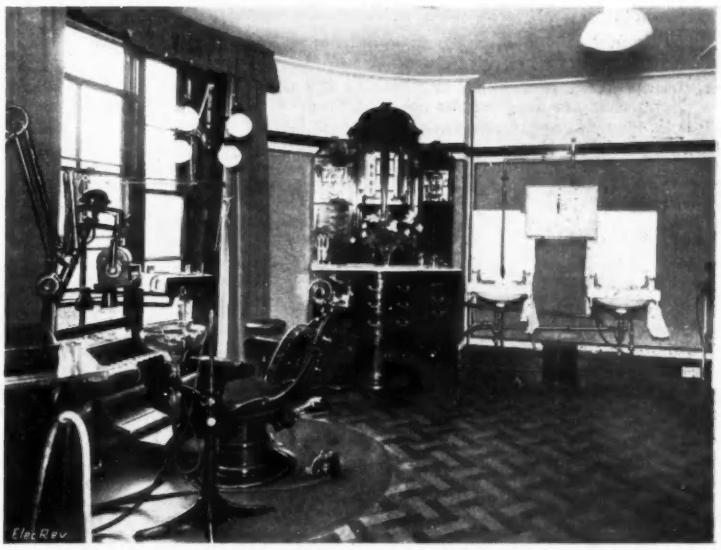
All these forms of treatment are provided for at the clinic at Clapham Common of the London General Omnibus Company's Employés' Friendly Society, which was recently opened by the Minister of Health. This building has been equipped by, and at the expense of, the Society almost lavishly on up-to-date lines and is being administered in close association with the Manor House Hospital, which will cater for the necessary medical and surgical requirements, conduct bacteriological examinations, and prepare vaccines.

The electro-medical and hydrotherapy equipment was supplied by the Medical Supply Association, Ltd., and the dental apparatus by the Dental Manufacturing Co., Ltd. The heating installation was carried out by Benham and Sons, Ltd., and the electrical wiring by Pruden & Pope.

In the basement is a room containing the meters, switchgear, M.E.M. distribution board, and a motor-generator (Brook Motors, Ltd.) for converting a.c. to d.c. The oil-fired boiler house contains motor-driven blowers, the linen store an electric heater, and the various mud, peat, and water-treatment rooms include a motor-driven compressor for the whirlpool and aeration baths, &c.

On the first floor are the massage and electrical treatment rooms. Artificial-sunshine treatment is provided by two installations of the quartz mercury-vapour type of ultra-violet-light apparatus, which is available not only for the treatment of rheumatism, but also as a prophylactic measure, as it has been indicated that by this method the common cold can largely be avoided. A reaction on the patient's skin, precisely the same as obtained on the sea shore in midsummer, can be obtained by this treatment with only a few minutes' exposure. The Grevillite therapeutic lamp is another form of what is known as phototherapy; the rays emanating from this apparatus are made up of infra-red radiation, a small proportion of ultra-violet radiation, as well as visible radiation, and they have beneficial effects in cases of lumbago, sciatica, and rheumatism.

Equator diathermy treatment apparatus is capable of producing internal heating of the patient's tissue. This instrument is capable of passing current through a patient without any of the electrical effects, or shock, that is usually associated with the passage of an electrical discharge. Because the patient experiences no electrical sensation a current of considerable magnitude can be safely passed, and it heats internally the limb to almost any extent desired; it is therefore frequently selected for the treatment of rheumatic joints.



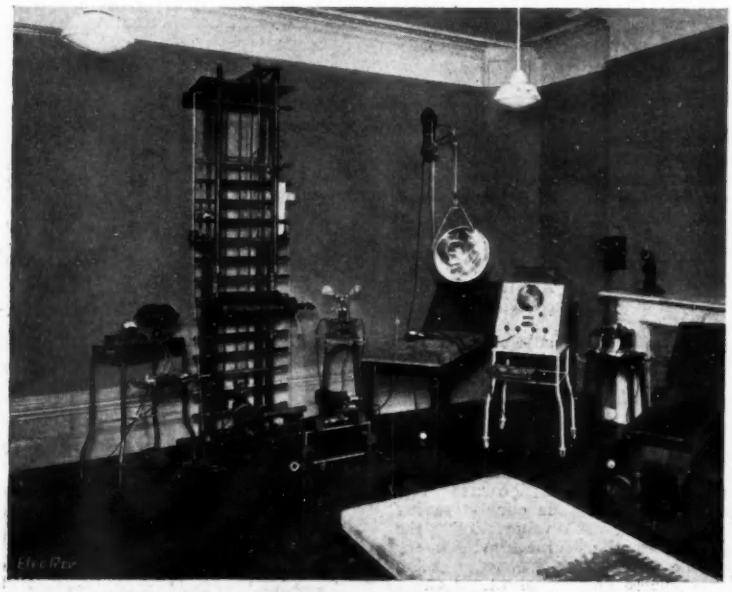
A View in the Dental Surgery

The "Emesay" health motor is an electro-mechanical device for applying mechanical energy to the body of a patient in the form of mechanical massage. By this method the waste products of the body are agitated, and by means of the increased blood supplied to the part following the massage a flushing of the patient's flesh is obtained, thereby supplying the part with increased nutrition and at the same time producing a marked exhilaration and tonic effect. "Penetrator" vibratory massage apparatus is driven by a small electrical motor sufficiently light to be held in the hands of the operator, enabling vigorous massage to be conveniently and quickly applied to any desired part of the body.

In the hydro-therapeutic bath the four limbs of the patient are placed in four vessels containing a solution which is frequently medicated with drugs. The four baths are connected to electrical apparatus known as an earth-free universal machine and electrical currents of various characteristics are passed into the baths after passing through measuring instruments and controlling apparatus. If the baths are filled with medicaments (such as salicylate of soda, sulphate of zinc, sulphate of copper, &c.), the passage of the current drives into the tissue of the patient the drug which is employed, and the apparatus is so arranged that concentration of current can be obtained at either of the patient's limbs when so desired.

Dr. Mennells' combined Swedish remedial apparatus, exercising plinth, and stirrup, are designed to facilitate what is known as purposive movements in order that groups of muscles may be specially brought into operation; the apparatus permits of a large variety of remedial exercises.

"Remedico" high-frequency apparatus is used for the purpose of producing currents in oscillation and is particularly useful in those



Corner of Electrical Treatment Apartment

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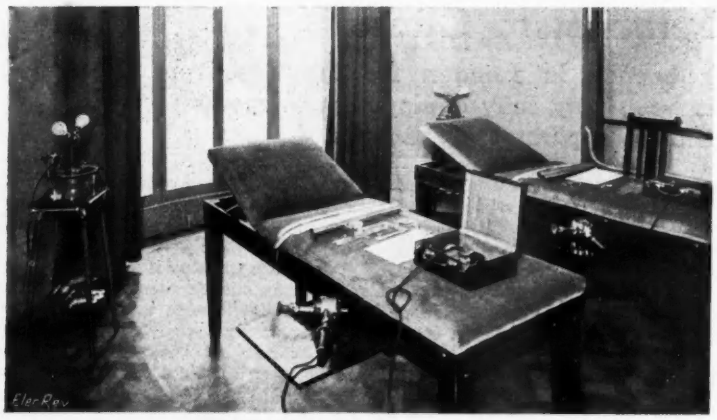
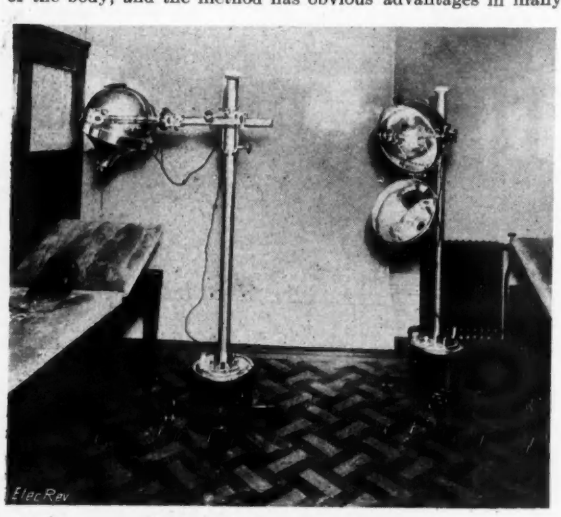


Electrical Equipment in Massage Room

rheumatic conditions which originate in the nervous system.

Galvanosets are designed for the production of galvanic and faradic currents used in treatment for their ionisation effects. By means of this apparatus medicaments can be electrically deposited into the tissue of the patient at any desired part of the body, and the method has obvious advantages in many



Sun-ray Treatment Apparatus

respects over the method of applying drugs by the mouth, inasmuch as the drug is more or less localised, and a greater quantity can be absorbed at the desired part of the body than would otherwise be the case.

The electrical baths for balneology which have been installed provide for treatment by the whirlpool and aeration methods, for Vichy douche, needlespray treatment, and all types of medical water baths.

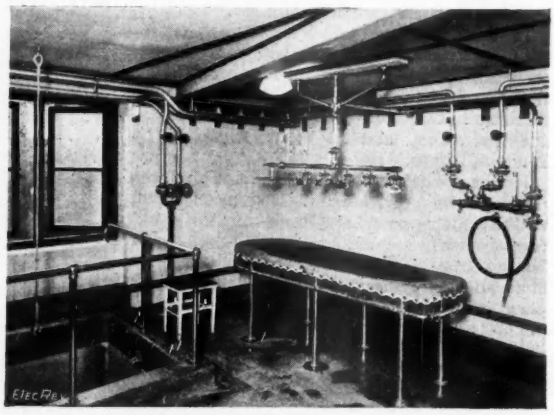
On the first floor of the building are the several dental surgeries, one of which is illustrated herewith. Their equipment includes electrically-driven tooth-drills, a "Victor" X-ray outfit, "Benham" electric water heaters for the wash basins, and electric instrument sterilisers, while the "Pelton" system of diffused artificial lighting has been installed.

On the top floor are an X-ray plate dark room and various workshops fitted with dental lathes, &c., and an electrically-heated "Belling" dental-plate drying oven.

It will thus be apparent that the new clinic is intended mainly for the dental preventive and what may be termed hydro-electrical curative treatment of the L.G.O.C. employés, the medical aspect being of secondary importance, since no drug has so far been discovered which will cure arthritis. Medicine is administered simply for the relief of pain, correcting anæmia, and other attendant symptoms of the main disease.

It is perhaps not generally realised how widespread chronic rheumatism is among the adult population. In the year 1922 careful examination was made of the incidents of rheumatism among the insured persons on the lists of 49 doctors. The total number of persons on the lists was about 91,000, of whom 58,000 were males and 33,000 females.

An average of no less than 62,000 working man-years are lost yearly due to sickness and disablement from rheumatism



Installation in Water-treatment Room

alone. Each year an average of nearly £2,000,000 is disbursed in sickness and disablement due to rheumatism alone, representing a loss of over 3,000,000 man-weeks of labour.

The consequent amount of discomfort and distress, which cannot be measured in figures, is indeed an extremely serious and pathetic matter.

Domestic Washing Machines

Savings effected in the author's own home

IT is interesting to discuss the reasons for the popularity of the electric washing machine in the U.S.A. and Canada, compared with the lack of it in this country. Over there a dearth of servants exists and people therefore turn to small flats and labour-saving devices. In our cities, houses with gardens are more popular than flats and, as our servant problem is not yet so acute, traditional methods are slow in passing away. Other reasons are the high prices of machines and a doubt about the effectiveness with which they can wash really dirty clothes.

Demonstrations of manufacturers are often half-hearted, judging from the number of people who leave them with the impression of just one clean towel being swirled round in clean water! Demonstration machines should be sent with an attendant round to all interested consumers for trial with a week's washing in their households. Even though the cost is high, the saving effected is great. In cases known to the writer in which laundries were used previously, the saving has amounted to over £5 per head per annum. With a family of five the large size of machine pays for itself in under two years. Obviously, the saving is greater in larger households than in smaller ones.

In cases in which the washing is done by washerwomen, the installation of an electric washer will cut down the time to a third. The system of payment by instalments should be excellent also, as the money saving in each period would balance the instalment.

A point that would improve many machines would be the fitting of a waste pipe with a flexible hose coupling, as is shown in the adjacent illustration. A rubber hose could also be used for filling; otherwise the necessity of lifting heavy buckets rather discounts the labour - saving value of the machine.—G. S. WILTON, B.Sc. (Edin.), Grad. I.E.E.

Electricity and the Farmer. By D. N. McHardy, N.D.A.

Critical views by the head of the Engineering Department of the Harper Adams Agricultural College on the present position and future possibilities of the application of electricity to agriculture

AS a general agricultural engineer, with no special interest in the use of any one form of power in preference to another, I believe that electricity has much to offer the agriculturist, but that it will do comparatively little to lower his costs of production. In the light of existing limitations and present knowledge of the application of electricity as a motive power, the vision of farms "run by" electricity is more likely to appeal to the lay mind than to the practical farmer.

It is to be feared that more than one executive of electricity undertakings has allowed his imagination to override discretion in working out development schemes for agriculture, and there is not wanting evidence to show that apparatus has been constructed and programmes have been laid down with little or no appreciation of the real needs of the farmer or the conditions in which he lives and works.

And here I would interpolate that for present purposes I mean by "farmer" the man engaged in typical husbandry operations, occupying a mixed farm of from 50 acres upwards, of whom there are over 140,000 in England and Wales. The specialists, with small acreages under poultry, fruit, market gardening, and so forth, come into a different category.

The Inestimable Boon of Good Lighting

Were I endeavouring to sell the mixed farmer electricity, I should concentrate first and foremost on light. It must be remembered that the business of farming is one of the few in which home and business are inseparable. Both in the farmhouse and in the farm buildings electric light is probably the greatest boon ever given to the countryman. Manufacturers of lighting sets for private use have done a great service to the farming community, providing a source of supply years before the distribution of current in the country was thought of.

The alternatives to electric lighting on the farm are, first, the paraffin lamp, with all its drawbacks of smell, poor illumination, fire risk, wastage of time in filling, and, secondly, the various vapour lamps, which are also open to some of the same objections. These are intensified—especially fire risks—when the lamps have to be used in stock buildings littered with straw, while the efficiency of the work is seriously impaired. It must not be overlooked that much of the routine work with cattle—including milking—is carried out in darkness both morning and evening for nearly six months every year.

The case for electric lighting is so unanswerable that I am convinced that very few farmers will resist its adoption once it becomes available.

Further, its convenience and special suitability for farm conditions are backed by a real, though somewhat indefinite, lowering of costs. It will be generally conceded that work of any kind can be better carried out in good light than in bad, and this argument will appeal specially to anyone with a herd of milking cows. Fewer losses by spillage are experienced in good illumination, while it is essential for the maintenance of a high standard of cleanliness.

Then, in the case of sick or breeding animals during parturition, the availability of good lighting plays an important part in carrying out the necessary operations successfully. Here it may mean life or death for the stock. And so examples might be adduced without number.

Power for Barn Machinery and the Dairy

From lighting to the use of electricity for operating stationary barn machines of low horse-power requirements is a comparatively easy step, for here, again, convenience makes a great appeal.

Most of the stationary power-operated machines on the farm are concerned with the preparation of food for live stock and, to a smaller extent, the handling of milk. In the first category come the chaff-cutter, cake breaker, root cleaner and pulper, and the grinding mill. In average circumstances an 8-h.p. motor will suffice for operating all of these—not simultaneously, of course.

But the fact must not be overlooked that some of these machines are being gradually eliminated. They belong to the farming practice of the past. Feeding experts advocate the feeding of fodder long, and condemn the use of the chaff-cutter as unnecessary and undesirable. They, or many of them, consider roots too expensive to grow, and replace them with other foods. There is now no need for the cake breaker, since practically all feeding cakes can be purchased ready broken or in the form of cubes. Thus, our barn machinery of the fixed type is whittled down to one machine—the grinding mill.

There remain the threshing machine and the ensilage cutter and blower, two items which, on account of their requiring from 12 to 20 horse-power for their operation, are eminently adapted to be driven by means of a tractor. As there is also a tendency for the size of grist mills to increase, it may be accepted that in future practically all the barn machinery will be tractor operated.

The low-power drives required in the cowshed and dairy for milking machines, separators, churns, &c., remain admirably suited for electrical operation, while pumping a water supply is a closely allied job.

Electricity for Heating and Cooking

The employment of electrical heating devices about the farmstead is, of course, a matter in which electricity undertakings are particularly interested. As regards the average farmer, I think there is little prospect of doing much in this direction. A few domestic appliances may be used, as well as incubators and hovers, but here the heating load is likely to end.

Sheep-shearing by Electricity

There appears to be an idea that cookers for pig foods and so forth are in request; but, so far from this being the case, it has been definitely established that there is no advantage in cooking foods for stock, and this old-fashioned practice is being gradually scrapped.

The Part Played by the Mobile Tractor

Reference has already been made to the tractor as the operating power unit for threshing and silo filling. Just for a moment let us ignore the type of motor used in the farm tractor and review its present position in agriculture.

After a chequered career during its years of development, the farm tractor as a general-purpose machine is now definitely established as a standard item of equipment on the typical British mixed farm. There are tens of thousands in regular use. The chief characteristics of the general-purpose machine for this country include: ability to move without delay from field to field and job to job; to work over or amongst growing crops, trees, fruit bushes, &c.; to have a total weight not much over 30 cwt. (the lower the better); to possess a motor giving 25 to 30 h.p. on the brake with a draw-bar horse-power of 12 to 20; and a price of under £300.

The horse retained its position so long on the farm un-

challenged because of its great adaptability, the most essential feature of any farm motive power. That is why cable haulage—whether by steam or oil engine—never became universally adopted. It has never been more than a stand-by and has been almost entirely displaced by the mobile tractor.

At present by far the largest proportion of farm tractors the world over are motored by petrol-paraffin four-cylinder, four-stroke engines, which in their modern forms are convenient, efficient, and fairly economical. Their position, however, like that of the petrol car and lorry motor, is being seriously challenged by the high-speed, crude-oil engine.

Now, to what extent is electricity likely to oust the internal-combustion engine as the prime mover in the farm tractor?

This question may in great part be answered by another :—why have electric automobiles and trucks almost entirely disappeared from the roads, closely followed by electric trams?

Possibilities of the Future

On the one hand, accumulator design has been unable to compete with that of other forms of prime mover, either on the score of costs or of convenience; on the other, the restricted movement of the tramcar has proved the main reason against its retention. In the case of the farm tractor, all these considerations apply, with, perhaps, even greater force. I do not consider that any form of electric tractor depending upon drawing current through cables has the slightest chance of success. To whatever low operating cost such an outfit might attain, the inconvenience alone would be sufficient to bar it as a practical proposition.

There remains the possibility of accumulators being produced capable of fulfilling the tractor specification outlined above. They would have to be cheap, light in weight, and capable of being recharged in very little more than the discharging time. A tractor so equipped, which could be charged up during the night at a sufficiently low cost for electricity, would make a great appeal to the commercial farmer. Even here there would be the objection that in rush periods the tractor could not be worked all night. Incidentally, such a vehicle would also fit in with the requirements of road transport. Then, since we are considering possibilities of the future, if ever the transmission of energy without the use of solid conductors is brought into the realm of practical politics, the chances for the electric tractor would assume an entirely new complexion.

Instead of regarding the internal-combustion engine as a competitor, the electrical manufacturer—as most indeed do—should take it as an ally. For some years to come, at any rate, there will continue to be a demand for private lighting sets, and for use with these and with public supplies there is a wide field for the development of small farm equipment. The production of starting and lighting sets for the oil tractor will soon become an important item of business, since modern design tends to their adoption.

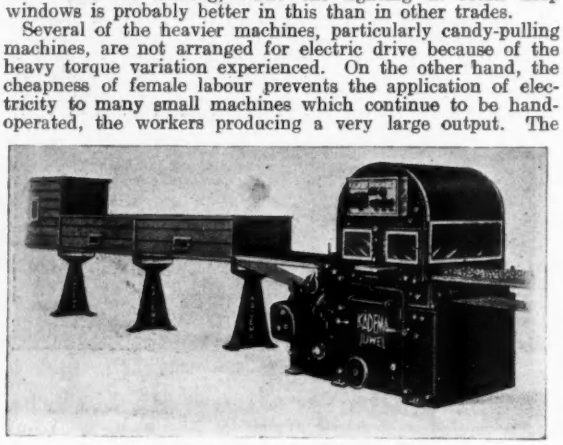
I believe the effect of rural electrification in the long run will be to raise the general efficiency of farming operations very greatly, but not in any spectacular manner. It will certainly raise the standard of living, and thus attract to and retain on the land more and more of the best types of farmer and farm worker. Both their productive and their marketing activities should react to the better conditions of life, and the efficient methods resulting cannot fail to lead to improved returns.

Chocolate and Confectionery Exhibition. By Viola Ripley, B.Sc.

Some of the electrical features

ELECTRICITY is being increasingly used in the manufacture of chocolate and confectionery both for power and for heating, while the lighting of retail shop windows is probably better in this than in other trades.

Several of the heavier machines, particularly candy-pulling machines, are not arranged for electric drive because of the heavy torque variation experienced. On the other hand, the cheapness of female labour prevents the application of electricity to many small machines which continue to be hand-operated, the workers producing a very large output. The



"Juwel" Chocolate-covering Machine

machines exhibited at the Chocolate and Confectionery Exhibition which was opened at Olympia, London, last week are taken in sequence in the production of chocolates and confectionery.

The new Bauermeister Patent Automaton chocolate mill, shown by F. Jahn, produces chocolate mass from roasted cocoa nibs and coarse sugar. The milling process causes a temperature rise to between 70 deg. and 90 deg. C., depending on the proportion of sugar, so that no additional heater is required. The milled powder falls into a container over a cylindrical ribbed magnet which removes iron particles. The whole machine is driven by a direct-coupled 15- to 20-h.p. three-phase motor. The same firm exhibits the Kustner chocolate depositor, fitted with a new device for altering the weight of chocolate deposited within 30 seconds. The mixer has a water jacket fitted with an electric heater controlled by a thermostat operating a mercury switch.

The new "Juwel" Kadema chocolate-covering machine, shown by Bart-Newhill, is electrically heated throughout by economical dry heaters. The temperature of the chocolate tank can be regulated by a three-stage switch or by thermostatic control. Electric motors are used for the main drive and to work the fan in the cooling chamber.

Bramigk shows the electrically driven "Lehmann" chocolate shell producer and the "Rakama" continuous caramel-cutting machine, also electrically driven and under working conditions. The soft caramel is cooled on the moving band by an electric fan. The "Universal" cutting machine for all kinds of confections and the "Turnbull" candied-peel cutting machine, shown by Wm. Brierley, Collier and Hartley, are electrically driven for the first time. Hansella exhibit a new electrical machine which cuts and shapes the sweets and delivers them in batches of six with waxed paper between them.

The Rose "Eagle" cuts, shapes and wraps caramel at the rate of 250 sweets per minute, and the triangular folds in the wrappings are sealed electrically. Most of the wrapping machines seen were electrically driven; examples are the "Cracker Bonbon Twist" machine shown by Rose, which wraps three coverings each round 120 to 140 cylindrical sweets per minute; the S.I.S. machine shown by Paillard and Benoit; and Lauenstein's new machine designed for cellophane. Fisher's Foils show an electrically driven packing machine which makes and fills cellophane bags in a continuous process. Southall and Smith's electrically-driven cocoa-weighing machine produces from 18 to 30 quarter pound packets a minute.

Some interesting electrical apparatus was included in the composite display of scientific apparatus. Hearson's showed two improved electric test-tube centrifuges, and the Cambridge Instrument Co., Ltd., and Tinsley's both showed electrical apparatus for determining the active acidity or alkalinity of solutions.

A new distance thermometer used for sugar boiling was shown by Fosters, and one by the Cambridge Instrument Co. (ELECTRICAL REVIEW, March 27th, 1931, p. 566), depending on the variation of resistance with temperature of a spiral of platinum wire which is compared with a fixed resistance in a modified Wheatstone bridge circuit, the galvanometer being calibrated with a temperature scale. Its advantage is quick reading, small changes of temperature being registered almost instantaneously and larger changes within four seconds.

Electrically-driven Test-tube Centrifuge

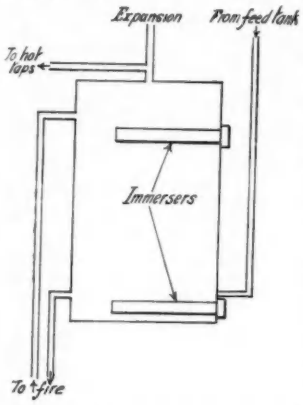
There was no special display of lighting equipment, but the exhibition windows were very effectively illuminated.

Converting Water Systems

The merits of various methods of adapting existing hot-water arrangements to electrical heating are discussed

By A CONSUMERS' ENGINEER

HEATERS used in the conversion of existing hot-water systems to electric heating are of two classes: (*a*) those fixed internally, and (*b*) those fixed externally. The first ("immersers") were, in the earliest examples, of the "blade" type, consisting of one or more mica-sandwich elements in a flattened sheath, mounted on a gland for screwing into the water container. Really well-made heaters of this type were costly to produce, and poorly-made ones were prone to fail. Any failure of the element or puncturing of the sheath entailed drawing off the water from the container before a replacement could be effected. As a result, "tubular" heaters were developed, in which the heating element could be slipped into or out of the tubular pocket without interfering with any water joint or running off the water. For use in rectangular storage tanks they are very good, but in cylindrical construction it is often difficult to get the required loading into a tube which is shorter than the diameter of the cylinder unless the diameter of the tube be made greater than can be easily fixed in the cylinder periphery. This necessitates the fixing of two heaters, and brings up the cost. Such an arrangement nevertheless gives very good results, as one can be fixed near the top and one near the bottom, as illustrated. The upper one can be used for ordinary daytime requirements of the house, and the lower one can be put on in addition when baths are wanted. They can be connected through a three-heat switch so that the two elements are in parallel at "high," the upper one is on alone at "medium," and both are in series at "low." This arrangement does not lend itself very well to thermostatic control, unless two thermostats are used, and this, again, would increase the cost.



These heaters should not, unless the loading per sq. inch of surface is very low, be used in vertical positions, or the spirals will collapse, and further, "furring" of the tube will be more marked. There are some makes in which the spiral is carried round and not along the formers, and the possibility of collapse is not so great. Preference should also be given, other things being equal, to a heater which has the element spiral completely protected from the metal tube by the former. This is desirable not so much to avoid direct contact in the case of a breakage, but to avoid contact by any scale which may form on the inner surface of the tube and then break away. It is not likely to happen unless the heater is being overrun.

The Circulator

The only other type of "internal" heater is a "circulator," which is really an immerser with an outer tube, open at top and bottom, fixed vertically or obliquely from the top of the cylinder. Some care should be taken in deciding the actual type of element to be used for this vertical fixing. Hot water passes up the annular space between the tube and the heater, and is delivered to the top of the cylinder; circulation continues until the volume of water between the top of the cylinder and the inlet to the tube is heated; the layer of water below the bottom of the tube becomes hot eventually by conduction. As such heaters give a quicker delivery of small quantities of hot water at the top of the cylinder, they are very useful for ordinary domestic purposes.

When fitted with a three-heat switch and a thermostat, they are really satisfactory. They are cheap to fix, as it is not necessary to draw off the whole of the water before the hole can be cut, and only one hole is required. This advantage is somewhat discounted when a thermostat is to be fixed as well, as the best position for the thermostat with this heater is about half-way down the cylinder. A circulator with thermostat incorporated has been produced which seems to be attractive, and, if successful, will overcome this little difficulty.

The Earliest Types

"External circulators" were probably the first types of water heater to be used. They consisted of mica elements clamped against the outside of flattened tubes, through which the water passed on its way from the bottom to the top of the cylinder. The restricted area of the water way conduced to choking up, particularly in hard-water districts, and similar trouble was experienced in the sharp bends or elbows at the bottom of the circulator. As a class they were not successful, although one particular maker who placed his heaters inside the tubes and passed the water over them avoided troubles to a very marked degree, and still does so, by mounting the tubes in a drum connected to the storage vessel by easy bends. This arrangement permits of the water-ways being kept short, though still of rather small cross section, and also enables a large heating area to be exposed to water, thus keeping the loading per square inch of heating surface at a reasonably low figure. As in the case of all other external circulators, its fixing entails the emptying of the cylinder, as also does a repair to a water joint, but the elements themselves can be replaced, if necessary, without interfering with the water.

Any external circulator has necessarily a slightly lower efficiency than an internal one, owing to the greater surface exposed to air.

The External Belt Method

A further form of external heater is the belt made by a well-known firm. It is the cheapest heater to fix, and its position on the cylinder can be varied at any time if required. Its surface loading is reasonably low; but, unfortunately, the surfaces of storage vessels are often unsuitable for its use. To obtain good results it is necessary to tap the heater gently up to the periphery of the vessel, and frequently this cannot be done; sometimes there are bumps and dents in the surface, sometimes a riveted seam comes in the way, and often the cylinder is in a cupboard or a corner, where it is impossible to get round it to tap up. Where these objections do not exist, it probably offers more advantages than any other type of heater. Not least among them is the fact that a consumer will buy it rather than hire it, because he can easily dismantle it if he removes to other premises. This point is also in its favour from the point of view of undertakings who hire water heaters, though it is outweighed by disadvantages.

With regard to the possibility of dismantling in case of removal, or change of tenancy, although the Electric Lighting (Clauses) Act gives an undertaking the right to remove its fittings and fixtures, it is not clear as to what is their position with regard to making good any damage or alterations occasioned by the fixing or removal of them in tenanted property. This is a point to which it is suggested the E.D.A. Committee might give some attention, as it has an important bearing on the hiring of water heaters.

The only remaining type is that in which a heater is clamped or fixed underneath the storage vessel. These had a vogue some time ago and are still being used in some parts of the country. They are generally of the constant low-loaded variety with restricted water feed, so that approximately constant temperature is maintained. In the smaller sizes they have been found useful, but in the larger sizes their slow recuperation has been a disadvantage and they have not become generally popular.

X-rays in the Factory

In an article contributed to *The Times*, Sir Wm. Bragg, O.M., refers to the limitations imposed by eyesight on the observation of very small objects. The first limit is due to the structure of the eye; the image of any object on the retina must exceed a certain size, if vision is to take shape in the brain. The second limit is set by the nature of light itself; vision depends upon the scattering of light, and the object may be so small that the waves of light pass it by. X-rays are a new kind of light, which is fine enough to be scattered by very much smaller obstacles than is sunlight.

A few years ago the Department of Scientific and Industrial Research set up a committee to look for the best ways of applying the new method to industrial problems. To this end visits have already been paid to industrial centres by the staff of the National Physical Laboratory engaged upon the work, who have discussed with manufacturers the possible application of the X-ray analysis to their individual problems.

The N.P.L. Electricity Department

Several investigations of importance have recently been completed

IN order to make the results of the researches carried out at the National Physical Laboratory more readily accessible to the public, the annual report of the Laboratory (for 1930) has again been published as a number of separate pamphlets, as well as in volume form. These pamphlets are on sale at H.M. Stationery Office. The price of the complete volume of reports is 12s. 6d.*

The report on the Electricity Department (2s. net) by the Superintendent, Dr. E. H. Rayner, M.A., Sc.D., M.I.E.E., is divided into four main sections: *viz.*, I, Electrical Standards and Measurements; II, Electrotechnics; III, Wireless; and IV, Photometry. It would be a convenience to the reader if future issues were prefaced by a table of contents.

Electrical Standards and Measurements

For measuring self-inductance and effective resistance of telephone loading coils required as standards, frequencies up to 20,000 cycles per second have been used, compared with a maximum frequency of 4,000 cycles in 1929. A corroboration of the calibration of the Kelvin-Varley slide wire for ascertaining the phase angle on potentiometers and resistance-ratio boxes was obtained by the use of a number of 10,000 ohm resistances of the platinised film type; these resistances possess very small self-capacities and negligible inductances, and may therefore be combined in parallel without appreciable change of time constant.

Small alternating currents have been measured by copper oxide rectifiers combined with ordinary moving-coil d.c. milli-ammeters, the complete instrument being usually calibrated at 50 cycles per sec. and graduated to read r.m.s. values of current. Although the rectifier produces some distortion of wave-form, an accuracy of about 1 per cent. is obtainable in laboratory work, but commercial instruments were found to have large errors at audio frequencies that were independent of the current measured. These errors arose out of the capacities of the rectifiers, which in milliammeters were about 0.09 μF, and were due to the resistance of the instrument varying invesely as the square root of the current passing through it. Compensation was found possible by the provision of a suitable inductive shunt.

Magnetic tests on iron-chromium alloys showed that when working out the permeability curve up to H=100, at values of H above 5 an almost uniform decrease took place in the value of B for a given H with increasing chromium content, until, at approximately 70 per cent. chromium, the alloys became non-magnetic at room temperature. The coercivity showed little variation with the composition.

Some results were obtained in the determination of the ohm by the Campbell method. The mean of five observations gave one international ohm as equal to 1.00055 c.g.s. ohm. It is suggested that one of the most important sources of error is stray mutual inductance in the leads joining the various components of the bridge.

Characteristics of X-ray Tubes

The behaviour of the X-ray apparatus at present used by the Physics Department has been studied with the aid of a Duddell oscillograph. Owing to the smallness of the currents generally available in X-ray technique, the oscillograph has been used in conjunction with a three-electrode valve, which virtually transforms it into an electrostatic instrument as regards the power and current required to operate it. This combination of an electromagnetic vibrator and a valve has been found much more sensitive and convenient to use than an electrostatic vibrator alone. The current and voltage waves of the hot-cathode and cold-cathode types of X-ray tube under different conditions of use have been recorded and examined. With an a.c. supply, the voltage wave could be applied to the oscillograph through a capacity potential divider, but since the tubes were in general fed from a rectified supply, a resistance divider was necessary. This had to be of sufficiently high value not to affect appreciably the operation of the apparatus to which it was connected. A liquid resistance of amyl alcohol (300 megohms) was found to be satisfactorily stable and high enough in value.

Current Transformers, Insulators, and Cables

The development of nickel-iron alloys for the cores of current transformers has enabled them to be constructed with phase intervals between primary and secondary circuits less than a hundredth of that formerly possible, the best of which was 0.2 per cent., involving an error of indication of about 7 per cent. at full load and 20 per cent. at low loads. Instruments for measuring current and power can now be investigated to approximately uniform relative accuracy over a range of from 100 to 20,000 A.

A current transformer for 10,000/5 A has been obtained with a ratio error of 2 parts in 10,000 and a phase-angle error within one minute, from full current to 0.05 per cent. of full current.

The Central Electricity Board has requested the Electricity Department to study the question of depreciation of the surface insulating properties of transmission line insulators for high voltages, as under smoky and similar conditions the normal margin of safety in operation may be very materially reduced. Preliminary work in the laboratory shows that the value of the power factor of an insulator system is a valuable measure of the degree of surface depreciation. The capacitance also changes as contamination increases. Similar measurements are to be carried out on a large number of insulator systems erected in a district more than usually liable to smoke and fog; frost also may prove important.

The measurement of power expended in the insulation of high-voltage cables, carried out during the past few years on behalf of the British Electrical and Allied Industries Research Association, has been concluded up to 150 kV. The laboratory drafted a specification describing the method which is regarded as being least liable to error; this method employs the Schering capacitance bridge adapted for high voltage work, in which the adjustments are all carried out on the low voltage circuits of the system. The accuracy obtained is believed to be about 0.0001 in phase angle or power factor. The work has entailed the study of the "end effect" when testing high voltage cables. If serious errors are not to be introduced, the ends of the cable must be suitably prepared, especially when dealing with short lengths, and the errors due to the ends may usually be rendered negligible with lengths of 60 kV cable as short as one yard.

Wireless Research

The rotating loop beacon transmitter established at Orfordness, Suffolk, in 1929 has, it has been ascertained from reports from 160 ships, a reliable range of about 100 miles with the normal one- or two-valve receivers. Within this range 80 per cent. of the bearings are correct to within 2 deg., but no definite error is due to the beacon itself.

The N.P.L. has also been actively engaged in other wireless developments, including a rotating beacon transmitter free from night errors, ultra-short waves, receiving apparatus, aerials, and the side-band theory of a modulated continuous wave.

Photometry

The electrometer photo-electric photometer has recently been slightly modified so as to obtain more accurate measurements of directional candle-power on electric lamps run at different temperatures. The photo-electric cell, which is of the recent thin-film type possessing considerable sensitivity throughout the visible spectrum, is provided with a coloured filter so that the colour sensitivity of the combination is a very close approximation to that of the normal human eye. The investigation of suitable filters and photo-electric cells for this purpose has led to the utility of the photometer being greatly increased.

A new photometer, based on similar principles, but designed for the measurement of mean spherical candle-power, has now been completed, and an investigation with regard to the choice of the most suitable photo-electric cell and filter for use with the instrument will shortly be commenced.

Work has been continued under the guidance of the Illumination Research Committee on the measurement of the brightness difference threshold (B.D.T.) under different conditions of illumination. It appears that the effect of a glare source on vision at extra-foveal points is chiefly determined by the angular separation between the glare source and the test-spot, rather than by the angular separation between the glare source and the fixation point. Attention has also been directed to the determination of critical flicker frequencies.

In investigating the distribntion of transmitted light for samples of opal and etched glass under normal parallel illumination, measurements of brightness for angles of view up to 70 deg. from the normal have been made on thirteen samples of pot opal glass, of similar quality but of various thicknesses, on two samples of flashed opal glass, and on eight types of etched glass. In addition, the behaviour of milk dilutions at various concentrations has been examined. The measurements have included complete sets of readings for red, green and blue, as well as white light.

The results show that in every case the distribution of the transmitted light undergoes a change with increase in the thickness or degree of etching of the glass. While the curves obtained for the etched glasses appear to be all of the same type, those for media containing small scattering particles show considerable variations in form, even exhibiting features which suggest the existence of haloes for some of the thinner opal glasses.

In connection with the effect of the polished surface on the diffusion produced by an opal or etched glass, it has been possible actually to measure the percentage of the flux reaching the polished surface which is prevented from emerging by total internal reflection. This percentage varies between wide limits according to the degree of diffusion within the glass, but in every case the measured value was found to agree closely with that predicted from a study of other properties of the glass.

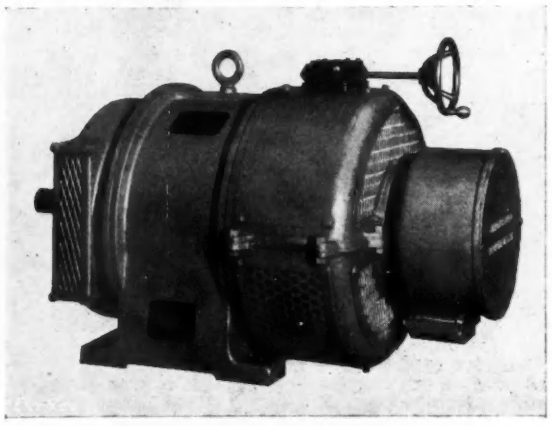
During the year a number of street-lighting installations have been tested for municipal authorities, electric light companies, and gas companies. In most cases sufficient measurements were made to indicate the distribution of illumination over a typical span of the lighting system. In connection with this work the illumination due to a number of street-lighting units has been measured on a laboratory road equipped for lighting experiments.

* See ELECTRICAL REVIEW, "The N.P.L. Inspection," June 26th, 1931, p. 1090.

A.C. Commutator Motors

The widespread adoption of alternating current has resulted in the paying of increased attention to variable-speed a.c. three-phase motors

COMMUTATOR-TYPE a.c. motors permit of a wide speed range, with good efficiency throughout, by merely altering the position of the brushes; they thus form a contrast to the ordinary induction motor, which is essentially a constant-speed machine. For some reason such motors have been, and still are, looked upon with suspicion by many users of electrical plant. The chief arguments advanced



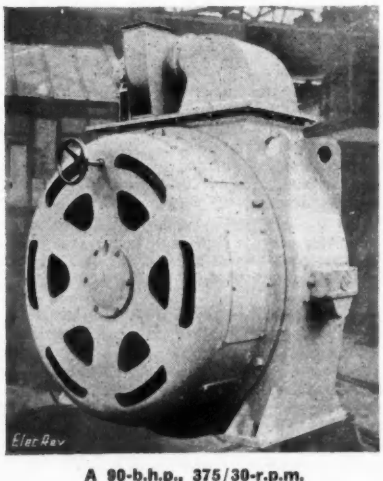
Shunt-characteristic Commutator Motor

against them have been high first cost, and their supposed complication, which has led to the impression that they require very skilled attention if they are to operate with any degree of reliability.

It is true that, comparing costs of motors only, a commutator-type motor is dearer than an induction motor of the same output; it is to be borne in mind that the commutator motor is generally installed for a special purpose for which the only adequate alternative is a variable-speed d.c. motor. To use a d.c. motor, however, when only an a.c. main supply is available, it is necessary to put in an a.c./d.c. motor generator, the price of which must be added to that of the d.c. motor; it will be found, therefore, that the commutator motor compares quite favourably in overall cost. Moreover, running and maintenance costs will be less for the commutator motor, since there will be only one machine, instead of three, to look after. In respect of the other argument, experience shows that the commutator motor is every bit as reliable as the better-known induction motor.

To meet the needs of printing offices, Messrs. J. H. Holmes and Co., Ltd., began to manufacture variable-speed commutator motors some years ago. It would not be easy to find a place where motors operate under more stringent conditions than the press room, and the description given below of the commutator motors in the offices of the *Daily Herald* at Manchester will effectively indicate the great reliability of motors of this type.

Two varieties of "Castle" commutator motors are discussed in this article, namely, the series-characteristic type (type "CS"), and the shunt-characteristic type (type "CH"). The former is the cheaper of the two, and is recommended for variable-speed drives in which the load increases with the speed. In these circumstances there is no risk that the speed of the machine will become excessive even if the load is reduced, because under the worst conditions, with the brushes set in the high-speed position, the speed would not increase more than 30 per cent. if the torque were reduced to one-quarter of the full-load value.

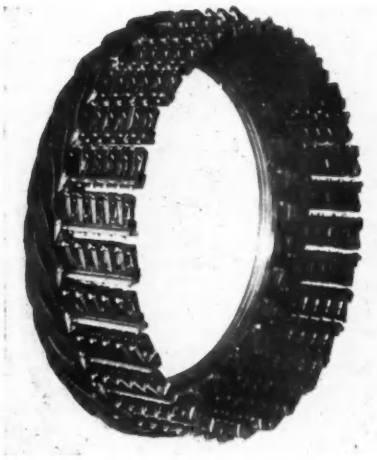


A 90-b.h.p., 375/30-r.p.m. Constant-torque Motor

There are, however, many drives for which this variation would be too great, and for these a shunt-characteristic motor is to be preferred. One suitable application, for example, would be where a number of speeds are required to suit changes in the nature of a process during a cycle of operations. With the shunt motor a practically constant speed can be maintained for any one setting of the brush-gear, the variation between full-load and no-load being only 5 to 8 per cent. Speaking generally, whenever a very steady speed is required, or when there is danger that the load may fall rapidly to zero, as would happen in a belt drive if the belt were to break, a shunt-characteristic motor is recommended.

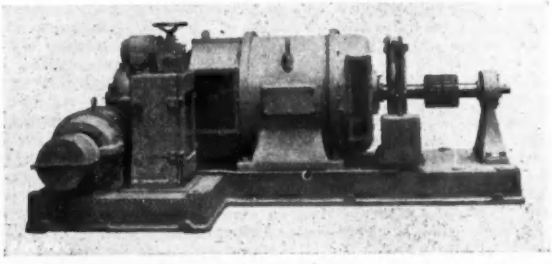
The normal speed range for which both types of motors are generally constructed is three or four to one; but Messrs. Holmes have built a motor with the very high range of 12½ to 1. As far as they are aware, this is the greatest speed range yet attempted, and a brief description of the motor will therefore be interesting. It was required for driving a super-calendar, an almost unique application for an a.c. motor in view of the large speed range, such calendars having hitherto been driven by a direct-current motors with shunt and series speed control. A range of 375 to 30 r.p.m. by brush-shifting was specified at a constant torque of 1,200 lb.-ft., and continuous running was required at any speed within the range, with occasional reversal of rotation. The supply was 3-phase at 220 volts and 50 cycles per second. A Continental maker had failed to meet the specification, and his motor was rejected on the test bed. It is all the more interesting, therefore, to record that the "Holmes" motor was offered for the customer's inspection three days after its first test run.

The low maximum speed necessitated a 20-pole motor with 30 brush arms, and the accompanying illustration of the brush rocker indicates the rigid construction of this very important part of the machine. The windings are series-connected with a series transformer feeding the rotor circuit, and the effective ratio of the stator and rotor conductors was determined by the necessity for stable running at the lowest speed. The self-ventilation of the motor was not sufficient for cooling, owing to its slow running, and an auxiliary motor-driven fan, mounted on the air outlet of the stator frame, was therefore included as part of the equipment. This acts as an induced-draught fan, and draws a constant volume of air through the main motor, whatever its speed or load may be. The switchgear for the main motor and the fan motor is all in one unit, and the set starts up as soon as the main circuit-breaker is closed. Interlocked isolating switches, only operative when the circuit-breaker is open, are provided for the reversal of the main motor; the fan motor runs always in the same direction of rotation. No other starting apparatus is required.



Brush Gear for 90-b.h.p. Motor

The motor is of the end-shield type, with ball and roller bearings, and the stator frame is of welded construction. Ventilation is mainly axial, air channels through the core being provided in both rotor and stator by a ring of punched holes in the stampings. The current-carrying connection between the transformer and the rotor brushes is through

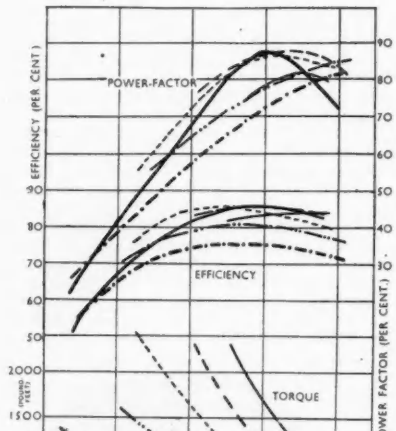


Series-characteristic Motor for Driving a Newspaper Press

heavy switch contacts, and thus the usual unwieldy flexible cables are avoided. The rotor winding is provided with equalising connections, and the brush arms are interconnected by heavy equalising bars.

The brush rocker is moved by a rack and pinion operated from a hand wheel, and a total movement through an arc of 360 electrical degrees provides for the full speed-range in either direction of rotation. On closing the circuit-breaker with the brushes in the central position, the current is one-fifth of the full-load current, and the torque increases as the brushes are moved until it reaches the value required for the driving of the calender.

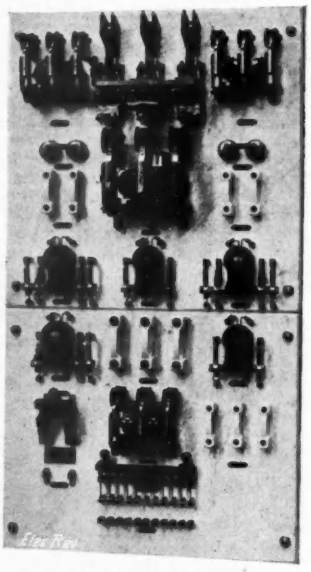
The curves shown below indicate the variations of torque and speed for different settings of the brushes. The corresponding values of power factor and efficiency are also given; the heavy full line shows the power factor and efficiency at a constant torque of 1,200 lb.-ft. over the complete speed range. The maximum power factor of 0.87 is lower than usual for a series-characteristic motor running at over synchronous speed, but in this special case the design was limited by the requirement of low-speed running. On test the motor was stable at all speeds, and it was even possible to keep it running at a crawling speed of 1 or 2 r.p.m. with a torque of about 200 lb.-ft. Commutation was excellent, and no sparking was noticeable even at the lowest speed.



Performance Curves for "Series" Motor at Printing Speeds

Seven duplex-motor equipments for driving a newspaper-printing press have been supplied for the Goss sextuple double-width presses at the offices of the *Daily Herald* in Manchester. Each set consists of a main series-characteristic motor, an auxiliary motor of the standard induction type, and a controller driven by a pilot motor. The auxiliary motor drives through the main-motor shaft for starting and inching, but is thrown out of action by an automatic relative-movement clutch when the main motor takes over the drive, which it does for all printing speeds. The entire operation of the press is controlled by means of "starting," "inching," "speed-up," "speed-down," "stop," and "safe" push buttons, mounted, together with signal lights, on a pedestal at each folder; the electrical circuits are so interlocked as to ensure correct operation under all conditions of working. Additional push-button boxes for partial control, with "inching," "stop," and "safe" buttons, and signal lights, are also provided for each unit.

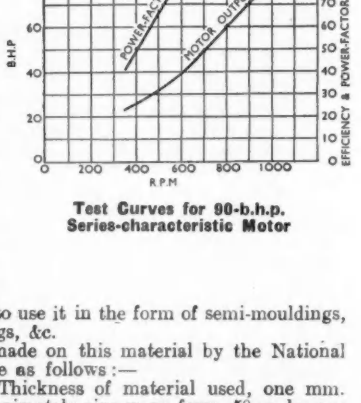
The brushes of the main motors are rocked by means of a pilot motor, which is also geared to the controller. The correct sequence of operation for starting the press from the auxiliary motor, and then switching in the main motor, is obtained as the contact lever travels along the controller face-plate; and the simultaneous movement of the brushes gives a steady acceleration when the main motor takes over the load. This acceleration continues as long as the "speed-up" push-button is pressed, and when it is released the press runs steadily at the speed it has attained. Pressing the "speed-down" button reverses the pilot motor, and so also reverses the movement of the brushes and gradually decreases the speed of the press. The "stop" button opens the main contactor, and this causes the pilot motor to bring back the controller and the brushes automatically to their starting positions. The switchboard for the main motor equipment includes a main circuit breaker or isolating switch for the supply, in addition to contactors for the main and auxiliary motors and the relays controlled by the several push buttons.



Controller for Duplex-motor Equipment

One notable advantage of the a.c. series motor is that, by suitable adjustment of the brush position, the starting current and the torque can be predetermined to suit the moment at which the pilot motor will close the main motor contactor. The current then taken is less than half of the full-load current, and the torque slowly increases as the brushes are moved by the action of the pilot motor, and all risk of breaking the web is avoided. The main motors at the *Daily Herald* printing office are designed for 85/21 b.h.p. at a speed of 1,050/260 r.p.m., and any speed within this range can be maintained.

These equipments have been in operation for twelve months without any hitch. The maximum wear of the original brushes is ¼ in., and most of them have not worn more than ⅛ in. out of the total wear of ⅞ in. provided.



Test Curves for 90-b.h.p. Series-characteristic Motor

Insulating Compounds

NATURAL mica, although possessing high dielectric strength, is unsuitable for many purposes. In many respects the electrical characteristics of glass closely approximate those of mica, but it is brittle and cannot be machined.

When a combination of mica and glass is subjected to a specific process, a substance having all the insulating characteristics of mica is produced, but it also possesses the necessary mechanical, chemical, and physical properties of an insulator capable of very wide application. Instead of incorporating the relatively expensive glass direct with the mica, certain raw materials, similar to those used in the manufacture of glass, may be more economically employed. The actual ingredients and proportions used may be varied according to the particular type of insulating medium it is desired to produce. These materials, when treated by a patented process, acquire the dielectric characteristics of glass, without the disadvantages of its brittleness and vitreous nature.

This material, termed "Mycalex," is produced in three grades, hard, medium, and soft, to cover practically all insulation requirements. It is produced in sheets up to 18 in. by 14 in. of from ¼ in. to 1 in. thickness, in round rods 14 in. long and from ¼ in. to 1 in. in diameter, and also in hexagonal rods. The flat sheets may be cut to the sizes required, turned on an ordinary lathe, or drilled with ordinary tools, while the round rods may be easily turned on a capstan lathe and shaped, screwed or threaded as required. It is found that the material does not flow so readily as softer and more unstable substances of the organic classes, and consequently it is possible to use it in the form of semi-mouldings, such as rectifier bushings, &c.

The results of tests made on this material by the National Physical Laboratory are as follows:—

Dielectric strength.—Thickness of material used, one mm. An a.c. voltage of approximately sine-wave form, 50 cycles per second, was rapidly increased until puncture occurred. Sample 1: breakdown voltage, 20,000 r.m.s.; breakdown voltage per mm., 20,000 r.m.s. Sample 2: breakdown voltage, 40,000 r.m.s.; breakdown voltage per mm., 40,000 r.m.s.

Surface breakdown.—Sample 3: surface breakdown voltage, 26,000 r.m.s. Sample 4: surface breakdown voltage, 25,000 r.m.s.

Water absorption.—The amount of water absorbed, tested by immersing the material in water for a period of 48 hours, was practically nil.

Oil absorption.—After immersion in grade "A" transformer oil for 48 hours the percentage absorption of two samples was only 0.55 per cent.

The permittivity at a temperature of 19 deg. C. (frequency 1,000 kilo-cycles per second) was 8.1.

The power factor at 19 deg. C. (frequency 1,000 kilocycles per second) was 0.0016.

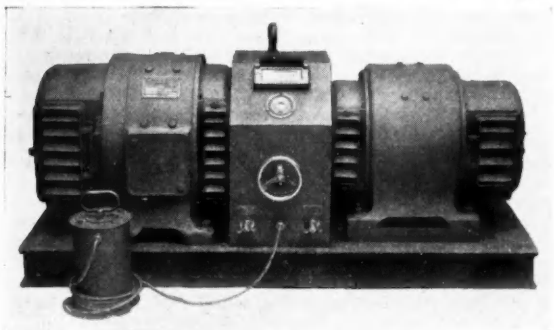
Such mica compounds are excellent high-frequency insulators, have a low temperature coefficient, and can be worked with ease and accuracy. They are not subject to any chemical change or deterioration, and are impervious to water, oil or gas. In general they are of such mechanical strength that a much thinner material may be used than is necessary with ebonite or other similar substances.—A. R. WILLIAMS, F.C.S.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Portable Welding Set

The new type S.G. portable motor-generator welding set introduced by the QUASI-ARC CO., LTD., 15, Grosvenor Gardens, Victoria, S.W.1, is a single-operator unit intended for use in situations where direct current only is available or where transformer plant is not suitable. It is a complete self-contained portable equipment and is suitable for all classes of electric welding, having a very broad current range and being built for continuous operation at its maximum output of 200 A. The components are of high-quality British manufacture and are very strongly built. The motor, generator, and switchgear are of weatherproof construction, making the set suitable for use in exposed situations. The motor can be wound to suit any normal electricity supply, and the generator is an improved patented drooping-characteristic machine, entirely self-stabilising and consequently requiring neither a separate exciter nor external stabilising gear.

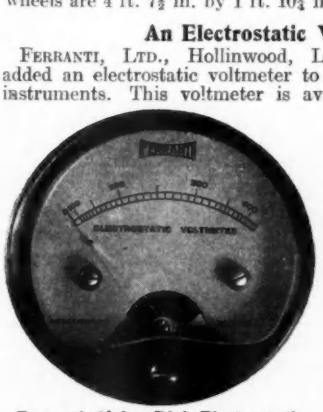


Quasi-Arc S.G. Welding Outfit

Easy welding conditions result in increased output and improved welding. Current regulation is effected by means of a radial switch, which gives four progressive ranges of output, in conjunction with a field regulator for the necessary finer control. The control gear and meters, &c., are contained in a substantial steel housing mounted between the machines, where they are accessible yet protected from accidental damage. The bedplate is braced diagonally, and lifting eyebolts are connected direct to the bedplate so as to preclude any possibility of upsetting the alignment of the machines when lifted. The set can be mounted on steel- or rubber-tyred wheels, or modified to suit a customer's special requirements. The usual accessories include an electrode holder fitted with five yards of flexible c.t.s. cable, a welder's screen, observer's screen, chipping screen, spare set of glasses, chipping hammer, wire brush and gauntlet gloves. The approximate weight without wheels is 13½ cwt.; and the overall dimensions without wheels are 4 ft. 7½ in. by 1 ft. 10¼ in. by 2 ft. high.

An Electrostatic Voltmeter

FERRANTI, LTD., Hollinwood, Lancashire, have recently added an electrostatic voltmeter to their range of 2½-in. dial instruments. This voltmeter is available in the flush, projecting and portable patterns, and is fitted in a moulded case to match the makers' 2½-in. dial moving-coil, moving-iron, rectifier, and thermal instruments. Various ranges are available from 0-450 volts to 0-2,500 volts, the first mark on the 450-volt scale, after the zero position, being at 100 volts. On direct current the instrument passes no current, and, as the minute current passed on alternating current is 90 deg. leading, it has no in-phase component and there is, therefore, no power loss. A protective resistance is embodied in the instrument case to minimise the possibility of damage to the instrument due to the application of an excess voltage.



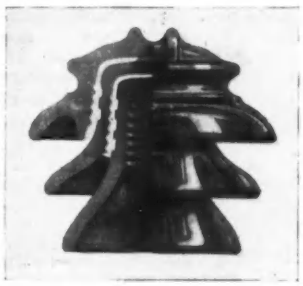
Ferranti 2½-in. Dial Electrostatic Voltmeter

"Bakelite" Laminated Sheet

BAKELITE, LTD., 68, Victoria Street, S.W.1, have just put on the market a new "Bakelite" laminated sheet made in two forms, one with a white surface and the other solid white throughout. The demand for white "Bakelite" electrical fittings has been increasing, and now that a sheet material is available in white, manufacturers will probably find it suitable for sub-panels on cookers, or for flush-type switch plates, &c. The properties of the new material are similar to those of ordinary grades of "Bakelite" laminated sheet, except that the specific gravity is about 1.8 instead of 1.35, the figure for other materials. The sheet will withstand considerable heat, boiling water or steam having no effect on it. The material is also recommended for labels for engraving purposes, providing a pleasing contrast to the usual white lettering on black sheet, or an alternative material to those which are already used.

Glass Insulators

We show one of a comprehensive range of glass insulators which has been introduced by ESTLER BROTHERS, LTD., Cecil Chambers, 86, Strand, W.C.2. The makers claim that they have arrived at that point in the development of glass insulation at which it can be universally used. Glass, being a material obtained by the complete fusion of its elements, is homogeneously perfect, and it is thus not necessary to submit it to porosity tests. Its transparency enables one to perceive the minutest effects in the mass, and to eliminate all pieces susceptible of causing trouble in service. Special apparatus only applicable to transparent material is used to disclose internal stresses which may have taken place in manufacture, thus avoiding the placing in service of pieces susceptible to cracking. The risk of failure in respect of the flashover value of the insulators is eliminated, as no surface treatment is required in manufacture, and little effect is caused by chipping or other damage in transit or during erection. Glass has an electrical resistance approaching infinity and a mechanical resistance comparable with the best porcelains, and its consistency is assured by vigorous chemical control and the rate of melting by the most modern pyrometric apparatus. It is also the only insulating substance used for electrical application which transmits light, heat, and electricity equally in all directions, and it acts in relation to the lines of force as an ideally homogeneous body.



Estler e.h.p. Glass Pin Insulator

Telephone Timing Attachment

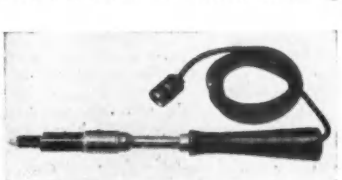
A novel little instrument has lately been introduced by the SOCIÉTÉ DE LA FABRIQUE D'HORLOGERIE, of St. Blaise, Switzerland, by means of which telephonic conversations can be timed. Of approximately watch size and designed for attachment near the telephone, it comprises specially-adapted watch mechanism for timing conversations from one to six minutes. At the beginning of a talk the finger is turned back to zero; it then advances as the time proceeds, a small bell also sounding a few seconds before the expiration of the three- or six-minute period.

Garage Equipment

We learn that FREDK. J. GORDON & CO., LTD., 92, Charlotte Street, W.1, have taken over the sole distribution, among other "Hartro" products, of the "Hartro" garage machine. This has been produced for the moderate size garage, and it appeals not only to the garage man, but also the transport user. The compressor has an output of 3½ cu. ft. per min., and is complete with pressure gauge, regulator, air filter and sprayer gun. It is suitable for paint spraying, tyre inflation, &c. A complete decarbonising equipment is supplied with the machine, and in addition there is a flexible-shaft attachment with a grinding wheel, polishing buff, &c. The power unit is a ½-h.p. motor with three speeds. It is completely detachable for use as a drill, or it can be operated through a flexible shaft. The power unit can be used for cylinder honing, and is equal in power for this purpose to a ¾-in. drill. A new unit is being developed for valve re-facing at a moderate extra charge.

An Electric Soldering Iron

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1, have put on the market an electric soldering iron known as the "Solon" which is to be demonstrated at the forthcoming Model Engineer Exhibition at the Horticultural Hall. Two voltage ranges are provided for—200 to 220 and 230 to 250—and the loading is 65 W. The iron is about 12 in. long and weighs about 1 lb. A 6-ft. length of flexible lead and an adaptor are issued with each "Solon," together with a supply of resin-cored solder. This solder is in the form of a tube filled with resin which melts out when heat is applied and thus acts as a flux; no other flux is required. The cored solder is supplied in quantities of ten 1-ft. lengths.



"Solon" Soldering Iron

Consumers' Complaints. By H. Southall

The appointment of a complaints clerk is advocated, and his procedure outlined

DURING the past few years most electricity supply authorities will have experienced a steady increase in the number of complaints received from consumers which necessitate visits of service men. To some extent this is natural in view of the ever-increasing numbers of consumers connected; in addition, the number of complaints increase also as the result of the growing popularity of electrical appliances in the home.

A few years ago when consumers using electricity for purposes other than lighting were in the minority the complaints received were of little consequence, and excellent service could be given without much effort on the part of the staff. To-day, however, in some areas where easy facilities are afforded for the acquirement of domestic appliances, the problem of dealing with complaints (with all due deference to the reliability of the apparatus) is becoming an important feature in the daily routine of undertakings. Prompt and reliable service attention to complaints is due to the consumer, and very necessary to the success of the undertaking.

When the advantages of electricity as a domestic aid are being stressed, the inconvenience caused by the cessation of supply, or the failure of an appliance, is being assessed at the same time—meaning that, if the virtues claimed for electricity are true, interrupted electrical service must be very disturbing to the housewife.

In undertakings which have many thousands of consumers a " complaints clerk " is a necessity. For this position a really intelligent junior with a good knowledge of the routine of the undertaking should be chosen; good telephone hearing is another desirable qualification for this position. All complaints made by mail, telephone, and orally should be handed to, or received by, him and each one should be recorded in a manifold book of numbered and perforated slips; the carbon copies should then be despatched immediately to the official responsible for attention to the particular complaint. It is safe to assume that such officials would have many other duties to perform apart from attending to complaints, and to guard against any pardonable omissions on their part a system of reminders could be arranged to be sent twice daily, or daily, by the complaints clerk until the complaint has been satisfactorily dealt with. The reminders need only take the form of an ordinary memorandum and the numbers of the original slips only would suffice. A simple way of advising the complaints clerk that attention has been given would be for the original slip to be returned to him bearing the date and time the service was given; if a " clock date stamp " were used by the complaints clerk on the slip issued for each complaint, a record of the exact time taken in attending the complaint would be available.

If all concerned with complaints made efforts to give consumers prompt and satisfactory service, nothing but benefit could result, as disgruntled consumers can probably do more to retard development than high tariffs, and, after all, it is their due. When complaints are being received by telephone, or in person, all the information possible should be obtained by the complaints clerk, and the full details should be recorded on the slip in order to avoid the possibility of a service man going insufficiently equipped to give the attention the consumer desires.

It would be desirable for the institution of the complaints clerk to be brought to the notice of consumers; this could be achieved by means of a notice on the quarterly accounts and by printed slips attached to communications sent to consumers. This would, in course of time, enable quicker connection to be established between the consumer and the clerk dealing with complaints, much to the relief at times of the telephone operator.

Further advantages may result from the direction of complaints to one person; they could be analysed and summarised, and valuable data showing the demerits of particular kinds of apparatus would be obtained; outstanding faults of a particular make of apparatus would readily be noticed by a study of the records. Where the complaints are of sufficient magnitude, it would probably be advantageous to detail service men, who should be specialists in the work, for dealing with delicate apparatus, such as vacuum cleaners, refrigerators, &c.

During the summer months undertakings have an opportunity of organising their service departments, and if they can improve their systems in any way they will minimise their winter worries and, incidentally, win plaudits from consumers.

The International Illumination Congress

ON September 1st, the first day of the International Illumination Congress, the Gas Light & Coke Co. and the London Electric Supply interests, both company and municipal, are joining in offering a lunch to the delegates at the Savoy Hotel. Delegates will have previously attended at the reception bureau at the University of London, South Kensington, and after the luncheon they will make a trip to the King George V Dock, returning to the Royal Naval College, Greenwich, for dinner, visiting the Beckton gas works or the Deptford electric power station on the way. After dinner, a visit will be made to the Tower of London, which is to be specially lighted for the occasion. The return will be made after dark to Westminster and a short drive will then be made to see the illuminated buildings. These will include the floodlighting of Buckingham Palace, Westminster Abbey, St. Paul's Cathedral (September 1st and 2nd only), National Gallery, I.E.E. Buildings, Westminster R.C. Cathedral, Somerset House, and County Hall. The illuminations will be switched on at 9.0 p.m. precisely, not only in London but all over the country. It has been estimated that the additional load provided by the displays in all towns will amount to at least 2,000 kW, of which 1,000 kW will be due to London.

The agenda for Wednesday include visits to places of interest in and around London. In the evening the official banquet will be held at Dorchester House, W., after which delegates will inspect the illuminations.

On Thursday the delegates travel by train to Glasgow, and on Friday morning (September 4th) the technical sessions open at the Royal Technical College, Glasgow, where 27 papers will be given in abstract, a maximum of 15 minutes being allowed for the author's remarks in each case. The subjects are divided into four classes : Lighting development, photometric precision, daylight and home lighting, and distribution problems. In the evening delegates will be received by the Lord Provost and Council in the City Chambers, and there will be an inspection of the street lighting system.

On Saturday a boat excursion on the Firth of Clyde has been arranged and on Sunday delegates will journey to Edinburgh where on Monday September 7th, further technical sessions will be held in conjunction with the annual conference of the Association of Public Lighting Engineers at the University of Edinburgh. There will be 34 papers, the subjects dealt with being public lighting, diffusing materials, aviation lighting, and physiological problems.

On Monday evening a reception by the Lord Provost and Council will be followed by a dance at the Edinburgh College of Art and an inspection of the street lighting system.

On Tuesday morning the annual meeting of the A.P.L.E. will take place and there will also be visits within the city. In the afternoon, train will be taken to Buxton, whence delegates will proceed by road to Sheffield on the following morning. After a reception and luncheon given by the Lord Mayor and City Corporation and the Sheffield Gas Co., there will be visits to places of technical and general interest and a return by road to Buxton.

Thursday, September 10th, will be occupied at Buxton with 23 papers covering industrial lighting, architectural lighting, the lighting of railways, mines, and kinema studios, light sources, and farm and horticultural lighting. In the evening train will be taken to Birmingham.

On Friday, September 11th, some 20 papers will be read in abstract in Birmingham, dealing with coloured signal glasses, light distribution, motor-car headlights, traffic signals, and heterochromatic photometry. In the evening a reception by the Lord Mayor and Council will be followed by a dance and a demonstration of automobile lighting undertaken in co-operation with the Royal Automobile Club.

A whole day motor-coach tour through the Shakespeare country will occupy Saturday, and on Sunday the delegates will take train to Cambridge, where plenary sessions and meeting of the I.C.I. will take place in Trinity College from Monday, September 14th, to Friday, September 18th. The subjects dealt with at the Cambridge Sessions will be: September 14th, street lighting, daylight, vocabulary; September 15th, lighting applications, coloured signal glasses, definitions and symbols, photometry, traffic signals, glare, and kinema lighting; September 16th, automobile headlights, photometric precision, and distribution of lighting flux; September 17th, aviation lighting, heterochromatic photometry, and education in the art of lighting; September 18th, street lighting, colour measurement, lighting of works and of schools, diffusible materials, and daylight. On one evening during this period a lecture will be given by Sir Arthur Eddington, D.Sc., F.R.S. Arrangements are being made for tours of the colleges. As in the cases of all the other tours, mentioned visits of interest for ladies and others not attending meetings will be organised.

On Saturday, September 21st, delegates will travel up to London to take part in the opening of the Faraday Centenary celebrations on the following Monday. The registered members of the Congress number 422.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The E.D.A. Calendars for 1932

The British Electrical Development Association has sent us, in good time, particulars of the two calendars which it has prepared for the coming year. Broadly they may be described as domestic and artistic. The domestic one depicts a lady in an apron putting on a switch, while at the side are little illustrations of seven domestic applications of electricity. At the head of the calendar, which has monthly slips, is the advice "Let Electricity Do Your Home Work." The second calendar is simpler. It bears a portrait of a pretty young lady, the design being mainly orange and green. This also has monthly date slips. E.D.A. is prepared to supply these in quantities of 250 upwards at reasonable prices, members of the Association being allowed a special discount.

Dutch Foreign Electrical Trade

During the first six months of the current year the value of imports of electrical machinery and apparatus into Holland was £2,287,498, as compared with £2,931,914 in the first half of 1930. The principal item was radio, telegraph and telephone apparatus, which fell in value from £777,250 to £589,833. Electrical machinery imports declined in value from £367,166 to £310,916. The share of the leading supplier, Germany, declined, but that of Great Britain, which occupies second place, experienced a slight increase. Dutch exports during the first half of this year were valued at £3,138,416, against £4,241,166 in January-June, 1930. In this section, too, radio, telegraph and telephone apparatus was the chief item, accounting for £2,064,583 of the total, as compared with £2,608,916 in 1930. The value of exported incandescent lamps declined from £848,166 to £636,500, and that of wires and cables from £197,084 to £141,750.

Patent Extension Applications

MARCONI'S WIRELESS TELEGRAPH CO., LTD., and the BRITISH THOMSON-HOUSTON CO., LTD., have applied to the High Court asking for the extension by four years of the periods of the following patents:—No. 15,448 of 1915, for "Improvements in circuit connections of electron discharge apparatus"; No. 148,129 of 1915, for "Improvements in and relating to means for obtaining unidirectional potential differences or current of constant value"; and No. 15,237 of 1915, for "Improvements in and relating to wireless signalling systems." The matters are to come before Mr. Justice Luxmoore in the Chancery Division in October 21st for directions as to hearing, and notices of opposition must be lodged at least seven days before that date at Room 175, Royal Courts of Justice, Strand, W.C.2.

Recent Contracts

MESSRS. BURNE-JONES & CO., LTD., inform us that they have received a contract for a further 3,000 radio receivers in connection with the "Wireless for the Blind" Fund. This brings the total number of receivers supplied by the company for the Fund up to 14,000.

A short time ago the LANCASHIRE DYNAMO & MOTOR CO., LTD., received an order from Greece for 900 special motors, mainly of the "Maxtorq" type, in connection with the change of the system of supply in Athens. The company has now received a further order for a large quantity of these motors. The order was placed through the Whitehall Securities Corporation, Ltd., of London.

Employés' Representation on London J.E.A.

The Minister of Labour gives notice that, as soon as possible after September 17th, she will designate to the London and Home Counties Joint Electricity Authority the employés' organisations having members in the employment of authorised undertakers in the district, in order that the organisations so designated may choose two representatives of persons employed in connection with the supply of electricity in the district to be members of the Joint Authority. Any employés' organisation desirous of being considered by the Minister for designation should make application in writing not later than September 17th on the form provided for the purpose, copies of which may be obtained from the Secretary, Ministry of Labour, Montagu House, Whitehall, S.W.1.

Northern E.D.A. Activities

The Northern Counties Area Committee of the British Electrical Development Association is to hold its monthly meeting on September 3rd at Carlisle, and on the occasion of this visit to Carlisle a luncheon is to be held in the "Crown and Mitre" hotel. Some 150 invitations have been sent out to prominent people in Cumberland to be guests of the Mayor and Mayoress at luncheon, and it is anticipated that about 100 members of the electrical industry will also be present. The speakers at the luncheon will be Miss N. Balls, chairman E.A.W., North-Eastern Area, and Mr. C. W. Salt, M.I.E.E., city electrical engineer, Carlisle. It is expected that a branch of the Electrical Association for Women will be formed for Cumberland.

The Rating of the Central Board's Property

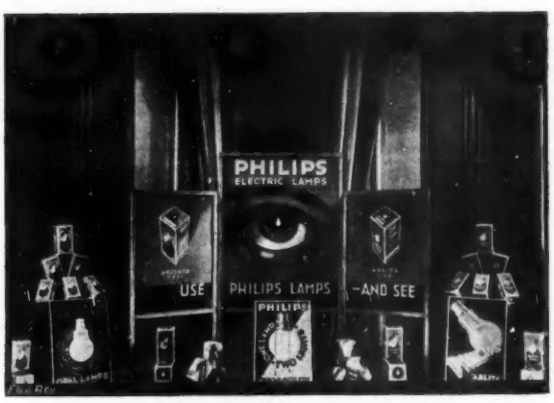
The annual report of the Central Valuation Committee states that it has been asked by the Central Electricity Board whether it would be possible to recommend uniform bases of assessment in respect of the trunk lines and transformer stations in the occupation of the Board. The question is still under consideration by the Committee.

Employment during July

The August *Ministry of Labour Gazette* states that employment in the engineering industry during July showed a further decline on the whole and remained bad. Little change was shown in the electrical section, in which employment continued slack. The total number of unemployed in the engineering industry rose to 271,853, or from 25.9 to 26.7 per cent. In the electrical section the figure remained stationary at 14.7 per cent., the total being 13,185. The number of unemployed in the electric cable, wire and lamp manufacturing group, at 16,057, showed a rise from 15.0 to 15.6 per cent., while the total of 3,877 in the electrical wiring and contracting industry represented a rise from 17.7 to 20.9 per cent.

Philips Lamps Publicity

For its 1931-32 lighting season campaign PHILIPS LAMPS, LTD., has adopted the slogan "Use Philips Lamps—and See," thus stressing the benefits conferred by proper illumination. This idea is present in one of the two shop-window displays which the company is making available to retailers. This display, which is illustrated, has a three-fold screen as a



A Philips Window Arrangement

centrepiece. In the middle panel is a large representation of a human eye, the pupil of which is a Philips lamp. The "Duo-Savelite" is also advertised in this arrangement. The second window display gives prominence to the slogan, the central position being occupied by a large hand grasping a giant lamp. In addition to these there is a special display to advertise the "Duplo" anti-dazzle automobile lamp, and various pamphlets, display cards, &c., all supported by extensive Press advertising.

Concession to Canadian General Electric

The Canadian General Electric Co. has been granted by the Canadian Government the exclusive right to manufacture oxygen-hydrogen generators, with the electrolytic cell apparatus, invented by Mr. A. T. Stuart, of the Ministry of the Interior, and covered by a patent held by the Crown. The cells are of great value to the companies making sulphuric acid, and other commodities wherein the electrolysis of water is an important phase. The Government reserves the right to review the prices at which the apparatus is sold.

The Victorian Commission's New Departure

The State Electricity Commission of Victoria has established an illuminating section in connection with its developmental activities. It has offered to place at the disposal of architects the services of experts who would undertake the preparation of specifications for electrical installations without obligation or fees. At a meeting of the Royal Victorian Institute of Architects at Melbourne strong comments were made on this action. Mr. P. A. Oakley said the Commission had no right to compete with paid consultants, and there should be no attempt by the Government to interfere with the private practitioner. Mr. W. O. McCutcheon maintained that the function of the Commission was to supply electrical energy, and it should not encroach on the domain of the seller of electrical goods. It was decided to write to the Commission drawing attention to the opposition of the Institute.

Latvian Tariff Increase

The duty upon electric accumulators and batteries, complete and in finished condition, upon importation into Latvia has been raised from 0.75 to 1.00 lat per kg.

Vickers-Armstrongs' Re-arrangement

Continuing its policy of concentration of production the board of Vickers-Armstrongs, Ltd., has decided to transfer from the Erith works the manufacture of the products at present being carried on there. The manufacture of the heavier products of these works has already been transferred to the northern works at Newcastle and Barrow-in-Furness, and the company now intends to concentrate the lighter products in its Crayford and Dartford works. Owing to the proximity of the three works the company does not consider that there will be any serious disturbance of employment in the district in consequence of this rearrangement.

Uruguay Bans Radio Sets

As a means of relieving the economic situation the Uruguayan Government has passed a number of measures. One of these prohibits the importation of certain "luxury" articles into Uruguay until June 30th, 1932; the goods scheduled include radio sets.

The "Siemens" Lamp Campaign

Siemens' Window Display

The "Popular Pair" (Opal and Pearl) are retained as the *motif* of the lamp propaganda of SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., for the forthcoming lighting season. They appear in the new window display centre seen in the accompanying illustration; on a counter showcard which acts as a stand from which leaflets can be taken by customers; on the leaflets themselves; and on a new showcard. This publicity matter will be supported by consistent advertising in the lay and trade Press. The window display opens out with a front box portion which is provided with three slots for displaying a central 60-W "Silvalux" (opal) lamp flanked by two 60-W pearls. These are illuminated from underneath by a 60-W lamp for which provision is made.

New Indian Companies

Among the companies recently formed in India are the Palghat Electric Corporation, Palghat, Madras, capital 1,00,000 rupees; the Khamgan Electric Supply Co., 19, Old Palace Building, Carnac Road, Dhobialao, Bombay Presidency, 5,00,000 rupees; the Chaj Hydro-Electric Power Syndicate, Lahore, 1,00,000 rupees; and the Chanda Electric Supply Co., Chanda, Central Provinces, 1,50,000 rupees.

Mavor & Coulson's Jubilee

Messrs. MAVOR & COULSON, LTD., celebrate their jubilee on September 4th. The company was founded by the late Henry A. Mavor in 1881, and was the first to carry the benefits of electricity into many Scottish towns. In 1885 (as Muir, Mavor & Coulson) they inaugurated in Glasgow the first electricity supply station in Scotland; the undertaking was purchased in the early 'nineties by the Corporation and formed the nucleus of the present extensive system. The first iron-clad completely enclosed electric motor was produced by the company in 1894, initially designed for service in mines, and in 1897 the firm began to build electric coal-cutting machines. The most notable individual work of the firm in electrical engineering was the development of Mr. H. A. Mavor's ideas with regard to marine electric propulsion on the three-phase system. The jubilee will be celebrated in St. Andrew's Halls, Glasgow, on September 4th, when 1,400 employés and friends will be entertained.

Chilean Installation Regulations

The Commercial Secretary to the British Embassy at Santiago reports that a decree, No. 1669 of May 11th, was published in the *Diario Oficial* of July 7th. The decree approves and codifies the regulations regarding the installation, &c., of electrical systems for the supply of electric light and electrical energy in Chile. A copy of the decree is available for loan to firms interested on application to the Department of Overseas Trade.

Book Notices

"The True Road to Radio" (pp. 243, illustrated). Hollinwood (Lancs.): Ferranti, Ltd. Price 5s.—This is the third edition of a work of considerable assistance to radio workers and amateurs. Although it naturally introduces Ferranti products in the appropriate places, there is no doubt that the value of the work as a guide to radio theory and practice places it above the ordinary run of trade "literature."

"The Quest for Power," by Hugh P. Vowles and Margaret W. Vowles, B.Sc.(Lond.). Pp. xv+354; fully illustrated. London: Chapman & Hall, Ltd. Price 15s. net.

"The Problem of Fluctuating Loads on Boilers," by G. E. Hider, A.M.Inst.C.E., M.I.Mech.E. Pp. vi+115; figs. 34. London: Charles Griffin & Co., Ltd. Price 7s. 6d. net.

"Television," by Sydney A. Moseley and H. J. Barton Chapple. Pp. xxvii+162; fully illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

"The Nature of a Gas," by L. B. Loeb. Pp. x+153; figs. 11. Price 12s. 6d. London: Chapman & Hall, Ltd.

"Foundations of Radio," by R. L. Duncan. Pp. ix+246; figs. 145. Price 12s. 6d. London: Chapman & Hall, Ltd.

"Electrical Engineering," by C. V. Christie. Fourth edition. Pp. xxi+662; figs. 571. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

New Catalogues and Lists

JOHN MOORES & Co., Ravald St. Works, Salford.—An illustrated and priced catalogue of radio receivers, radio gramophones, components and accessories.

BASTIAN & ALLEN, LTD., 26, Cross Street, Essex Road, London, N.1.—An illustrated booklet in which are given practical applications and technical details of "Bastian" electrode steam boilers and hot water circulators.

MCKECHNIE BROTHERS, LTD., Rotton Park Street, Birmingham.—A catalogue dealing with extruded rods and sections, stampings and pressings, chill cast bars, and ingots of non-ferrous alloys.

The BENJAMIN ELECTRIC, LTD., Tariff Road, Tottenham, London, N.17.—A brochure entitled "Scientific Decorative Illumination," dealing extensively with the "Shadowlite" principle. In addition there is some interesting data, with excellent photographs, on cornice lighting, decorative diffused lighting and lay lighting.

HEYES & Co., LTD., Water-Heyes Electrical Works, Wigan.—The August issue of the "Wigan Review," containing particulars of a new bath lighting unit.

J. J. EASTICK & SONS, 118, Bunhill Row, E.C.—The "Eelex Bulletin" for August containing particulars of new radio apparatus, notes on price-cutting, &c.

CURFEW ELECTRIC HEATERS, Curfew Poultry Farm, Gogmore, Chertsey.—An illustrated booklet describing the firm's poultry-rearing apparatus, including incubators, brooders, and foster-mothers.

WATSON & SONS (ELECTRO-MEDICAL), LTD., 43-47, Parker Street, Kingsway, W.C.2.—An illustrated descriptive leaflet of the "Watson-Sankey" portable X-ray unit. Priced.

CAMBRIDGE INSTRUMENT Co., LTD., 45, Grosvenor Place, S.W.1.—A specimen thermograph chart as produced by the company's instruments.

VAUGHAN CRANE Co., LTD., Openshaw, Manchester.—A folder, illustrating a number of examples of the company's electric cranes, pulley blocks, &c.

WORTHINGTON-SIMPSON, LTD., Newark-on-Trent.—Bulletin W.S.1152 containing illustrated information upon the company's oil line and pressure power pumps.

The CARRINGTON MANUFACTURING Co., LTD., 24, Hatton Garden, E.C.1.—An illustrated and priced list of radio cabinets.

W. MCGEOCH & Co., LTD., 46, Coventry Road, Birmingham.—Catalogue 1-G 9/31 (64 pp.) containing fully-illustrated particulars of the company's ironclad switch- and fuse-gear. Priced.

BOULTON & PAUL, LTD., Norwich.—Catalogue B6/2, a well-produced brochure illustrating and describing "Electolite" house-lighting plant; also a folder (B40/3) dealing similarly with the "Boulton" self-lubricating house pump.

WATLIFF & Co., LTD., 175, Merton Road, Wimbledon, S.W.19.—A series of four price and size lists relating to the company's commutators for fractional h.p. machines, automobile dynamos, and repulsion-start induction motors.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—A list of 66-kV and 33-kV cables supplied by the company to electricity supply authorities at home and in Australia.

MARBOURN, LTD., Block F, 120, Pratt Street, Camden Town, N.W.1.—An illustrated price list (No. 1) of tumbler switches, switches and plugs, lampholders, and other accessories.

WHITWORTH ELECTRIC LAMP Co., LTD., 6 & 8, Gorleston Street, West Kensington, W.14.—A price list of cables, flexibles, wiring system accessories, conduit and fittings, switch- and fuse-gear, bakelite accessories, &c.

BURNE-JONES & Co., LTD., 296, Borough High Street, S.E.1.—Four illustrated price lists of the company's radio sets and components.

STERNOL, LTD., Royal London House, Finsbury Square, E.C.2.—A pocket booklet, "First Aid for the Car," suggesting solutions for a number of motoring problems.

The Vienna Autumn Fair

The Vienna Autumn Fair is to be held from September 6th to 13th. A special section is to be devoted to electricity in the home.

Factory Regulations in the Free State

Draft regulations under the Factory and Workshops Act concerning the generation, transformation, distribution, and use of electrical energy were issued last week by the Minister for Industry and Commerce. Henceforth it will be the duty of the occupier of premises where such work is carried on to see that the regulations are adequately complied with. The object of the regulations is to secure the safety of persons engaged in work on premises where business in connection with electric power is carried on.

Trade Announcement

MR. G. E. S. VENNER recently removed from Budge Row, E.C., to Victoria House, Southampton Row, W.C.1. (Telephone: Holborn 6663.)

German Radio Exports

It is officially reported that the exports of radio apparatus from Germany in 1930 increased by 23 per cent. in weight, to 7,500 tons, and the value by 14 per cent., to 78 million marks, over the previous year. A further augmentation of 23 per cent. in the weight and 10 per cent. in the value also took place in the first six months of the current year, loud-speakers forming about 30 per cent. of the entire sales. On the other hand, the imports of radio apparatus are stated to have represented a value of 11,656,000 marks in 1929 and one of 10,810,000 marks in 1930 so that there was a favourable balance of nearly 68 million marks. The impending wireless exhibition in Berlin is expected to give a further impetus to the export trade.

For Sale

The West Central Merchandise Mart is to sell by auction on September 3rd the stock of an electrical and radio factor. (See our advertisement pages to-day.)

A Polish Electrification Scheme

A Warsaw message to *Industrie & Handel*, of Berlin, says that although the Polish Ministry of Communications has repeatedly stated that the proposed electrification of the new Warsaw terminus would be carried out by Polish firms and with locally manufactured material, and that only apparatus and machinery which could not be made in Poland would be procured from abroad, there are in fact good prospects for foreign suppliers in this connection. It appears that the Ministry is not in a position to finance the work out of its own funds. According to the *Gazeta Handlowa*, the Ministry would prefer to carry out the project with the help of a seven-year or ten-year loan.

The Austrian Electrical Manufacturing Industry

Owing to the measures of economy adopted by the Austrian Government, the electrical engineering industry has been disappointed over a good proportion of the business which it expected this year in connection with the electrification of the State Railways. The postponement of the construction of the power station at Persenbeug has been another disappointment. In consequence of the deferment of these plans, and as a result of price-cutting on the part of foreign competitors, the industry—particularly the high-voltage branch—is in a very depressed condition. Nearly all the works are adopting short time. There are prospects of some business with the South-Eastern States, notably Jugo-Slavia, where schemes for power stations are on foot, but they do not look very promising on account of the long terms of payment that are required.

Prices of Materials

Messrs. F. Smith & Co. report August 25th: No change in the price of electrolytic copper and silicium bronze wire.

Messrs. James & Shakespeare report August 25th: Copper bars (best selected), sheet and rod, no change. English pig lead, £13 10s.; 15s. increase.

Messrs. Edward Till & Co. report August 25th: India-rubber, Para fine, no change.

Unemployment

There was a new high record for the number of registered unemployed for the week ended August 17th, when the total was 2,719,376. This was an increase of 5,017 as compared with the previous week's figure. At August 18th, 1930, the total was only 2,017,957.

American Offer for Cuban Telegraph Systems

It is stated in the Cuban Press that private United States interests may purchase the Cuban Government's telegraph system, as well as the radio systems. A detailed account of the properties, earnings, and costs of the telegraph and wireless facilities is being prepared by the Cuban Government for Mr. Edwin R. Seligman, of the United States, who is now in Cuba. Mr. Seligman is said to be negotiating for the sale of the communication systems to an American syndicate. During the financial year 1930, the Cuban Government-operated telegraph system had gross receipts of $572,957, as compared with $623,124 in the preceding year. The number of telegraph offices in existence last year was 338 and they transmitted 1,264,944 messages, as against 332 offices sending 1,315,213 messages in the preceding financial year. During 1930, 15,050 km. of telegraph lines were under Government control.

Belgian Metal Wages

The *Financial News* reports that Belgian metal workers have accepted a reduction of 2½ per cent. in wages as from September 1st.

The "British Exhibitor"

The steamship *British Exhibitor* arrived in the Thames on Tuesday last for equipment by the firms who are displaying their products in this exhibition ship. The manufactures which will be shown will range from engineering products to carpets. The vessel is to sail for South America in about two months' time. The company responsible for this enterprise—British National Exhibition Ships, Ltd.—proposes to fit out two further vessels for world exhibition purposes.

Bankruptcy Proceedings

G. N. Adamson, Royal Station Hotel Yard, Carnforth, Lancs., electrical engineer.—The public examination herein was held recently at the Sessions Hall, Preston. According to the statement of affairs there were liabilities amounting to £263 and a deficiency of £156. Debtor attributed his failure to heavy travelling expenses; having to cut prices; being short of capital; and having to go considerable distances to obtain jobs, there being no electrical power in Carnforth. He admitted that he had been aware of his position for about six months but he had continued in the hope of securing work in increasing quantities.

E. Dunn (H. Mitchell & Co.), gramophone and wireless dealer, 14, Edensor Road, Keighley.—First meeting held, August 25th, at the Official Receiver's office, 12, Duke Street, Bradford. Public examination September 17th, at the County Court, Manor Row, Bradford.

J. D. Waller, electrical engineer and contractor, 51, Park View, Ilkley, Yorks.—First meeting held August 27th, at the Official Receiver's office, 12, Duke Street, Bradford. Public examination, September 15th, at the County Court, Manor Row, Bradford.

W. G. Harden and C. H. Chinery (trading as Harden and Chinery), electrical and mechanical engineers, 7, Barnsbury Street, Islington, London.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1, appointed August 13th.

W. M. Pratt and H. V. Clark (Magson Clark & Co.), electrical engineers, 165, High Street, Hornchurch, and 10, The Parade, South Benfleet.—Trustee, Mr. C. Latham, 78, New Oxford Street, W.C.1., appointed August 15th.

B. L. Cox, electrical engineer, 45, Shirland Street, Chesterfield.—First and final dividend of 2s. 1½d. in the £, payable August 29th at the Official Receiver's office, 73, Saltergate, Chesterfield.

N. Sutton (trading as "Sutton's Wireless Service"), 169, High Street East, Wallsend.—Receiving order made, August 13th, on debtor's own petition. First meeting to-day (Friday) at the Official Receiver's office, 81, St. Mary's Place, Newcastle-upon-Tyne. Public examination October 7th at the Court House, 56, Westgate Road, Newcastle.

R. E. Pearcey, motor and electrical engineer, 105, Arthur Street, Withernsea.—Receiving order made August 21st on debtor's own petition.

J. E. Connell, electrical engineer, 2, Russell Street, Downing Street, Manchester.—First meeting, September 1st at the Official Receiver's offices, Byrom Street, Manchester. Public examination, October 16th, at the Court House, Quay Street, Manchester.

R. Blood, wireless dealer and electrician, 44 & 46, Station Road, Padiham.—Discharge suspended for fourteen months, until September 30th, 1932.

J. S. Blackburn, electrician, Borough Street, Castle Donington.—Last day for receiving proofs for dividend September 9th. Trustee, Mr. D. S. Mackay, The Red House, Duncombe Place, York.

Company Liquidations

Gramo-Radio Amplifiers, Ltd., 1a, New London Street, E.C.—The first meetings of the creditors and shareholders was held on August 25th at the Board of Trade offices, Carey Street, W.C. A statement of affairs was submitted showing liabilities of £1,488 against assets of £59, and a deficiency with regard to contributories of £4,829, the issued capital amounting to £3,400. The Official Receiver reported that the company was promoted by Gordon E. Ward who was also the late managing director. It was registered as a private company on April 19th, 1929, to carry on the business of electrical and motor engineers, and wholesale and retail dealers in telegraphic, telephonic and wireless apparatus. The immediate object was to enter into an agreement for the acquisition of Ward's interest in an invention, which he had patented, for improvements relating to inter-valve couplings. The purchase considerate was £1,350, divided into £500 cash and £850 in shares. Agreements were also entered into for the company to manufacture and sell the inter-valve coupling devices. The trading accounts showed sales amounting to £5,992 and a net loss of £1,315. The failure of the company was attributed to lack of working capital and to the severe economic depression during 1930 and 1931. The liquidation was left in the hands of the Official Receiver.

Standard Radio Co., Ltd.—Meeting September 14th, at the offices of the liquidator, Bank Buildings, 1, High Street, Croydon, to receive an account of the winding up by the liquidator, Mr. W. Peet.

Bluck Electric Welding Machines, Ltd.—Meeting, September 21st, at 22, Hatherton Street, Walsall, to receive an account of the winding up by the liquidator, Mr. J. Tindall Bunch.

Brown, Gardner & Co., Ltd.—Winding up voluntarily. Liquidator: Mr. C. J. G. Hughes, 56, Moorgate, E.C.2.

Wynsor Electric Range Co., Ltd.—First and final dividend of 2½d. in the £, payable September 10th, at the office of the Liquidator, 1, Broad Street Place, E.C.2.

Meetings of Creditors

G. J. Scrogg & Co., Ltd.—Meeting of creditors August 25th at the Queen Hotel, City Road, Chester. Particulars of security to be sent to the company's office, Britannia Chambers, High Street, Holywell (Flints.).

Furnace Electric Heating Co., Ltd.—Meeting of creditors August 28th at the office of Messrs. K. A. & C. Peckett, 22a, Commercial Street, Halifax.

Transmatograph, Ltd.—A meeting of creditors was held yesterday, August 27th, at the Incorporated Accountants' Hall, Victoria Embankment, W.C.2.

Winding-up Petition

W. Boydell & Sons, Ltd., electrical and mechanical engineers, Leigh (Lancs.).—A petition for the winding-up of this company has been presented to the County Court of Lancashire, and will be heard at Bolton County Court on September 16th.

Reduction of Capital

Bankfoot Power Co., Ltd.—The reduction of this company's capital from £100,000 to £60,000 was confirmed by Mr. Justice Maugham in the Chancery Division on July 27th. It is proposed to restore the capital to its former level by the creation of 80,000 10s. shares.

Electricity Supply

Lighting, Domestic, Power

Aberdare.—YEAR'S WORKING.—The result of the operation of the Urban District Council electricity undertaking (engineer: Mr. W. E. Richardson) for the year ended March 31st last was a net profit of £1,391. Revenue amounted to £33,272, working expenditure was £21,524, and the gross profit amounted to £11,748. Capital expenditure during the year totalled £20,994, bringing the amount now spent on the undertaking to £141,003. Electrical energy sold increased from 2,479,138 in the preceding year to 2,630,934 kWh and the maximum supply demanded from 1,215 to 1,325 kW. The average price obtained per kWh fell from 3.27d. to 3.04d.

Australia.—ELECTRICITY FOR GOLD MINING.—The Victoria Electricity Commission's ring main now extends from Melbourne to Castlemaine, and a deputation recently urged upon the Minister in charge of electrical undertakings the construction of a further section to Ballarat. It was emphasised by the deputation that the supply of cheap electrical power would develop gold mining. The Minister, in reply, said a strong case had been made. The estimated cost of the complete ring main, which was approved by Parliament some years ago, was £500,000, and of the section now proposed £150,000. He would forward a report to the Mines Department, and if the statements of the prospects were correct the matter would be given serious consideration. Nine-tenths of the money would have to be spent on materials.

Barrow.—LOAN SANCTIONED.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £20,000 for the provision of mains and services.

Biddulph.—ELECTRICITY SCHEME.—Preparations have been made to afford a supply of electricity to the town by an extension of the mains from Knypersley. The estimated distribution costs are £6,000. The suggested charge is 9d. per kWh.

Brighton.—NEON SIGNS.—At a meeting of the Watch Committee the chief officer of the fire brigade drew attention to possible dangers existing in connection with the neon sign installations which were being erected upon numerous public buildings throughout the borough. He declared it to be essential for public safety, in view of the high voltage required for the operation of the signs, that special care should be exercised in both the wiring and installation. It was decided to refer the matter to the Licensing Justices and the Electricity Committee and to urge for the institution of regulations similar to those adopted by the L.C.C.

Burnley.—YEAR'S WORKING.—A total revenue of £112,622, as compared with £108,094 in the preceding year, is recorded in the accounts of the Corporation Electricity Department (engineer: Mr. J. E. Starkie) for the year ended March 31st last. Working expenses showed an increase from £65,207 to £70,006, while the gross profit was £42,616, as against £42,887. The net profit amounted to £18,113, as compared with £19,716. The total capital expenditure at March 31st was £600,323, an increase of £53,956 during the year. Sales of electricity increased from 13,104,543 to 14,228,921 kWh, there being a rise of 63 and 27 per cent. respectively in the energy consumed under the rateable value and heating and cooking tariffs. The average net price obtained per kWh was 2.119d., as compared with 2.350d. At March 31st the number of consumers totalled 11,578, an increase of 1,550 during the year. An interconnecting main between Nelson and Burnley was completed in July of last year for the purpose of permitting the Nelson plant to be closed down for repairs, and it is proposed to continue the use of this line in order to render mutual assistance and to secure economies in the running of the two stations.

ENCOURAGING ELECTRIFICATION.—In the course of his report, the engineer suggests that as an inducement to mill-owners and other large power consumers, the Department should allow a certain percentage of power units to be used for lighting. This would not only remove the temptation to these users to put down their own lighting plants but would also tend to raise the standard of illumination and thereby increase production. Mr. Starkie also says that as the heating of day schools could be carried out electrically, without encroaching upon peak-load hours, a special tariff should be offered for this purpose.

Canada.—DESTRUCTION OF PYLONS.—A number of linesmen employed by the Montreal Light, Heat & Power Co. left work two or three weeks ago on account of the company's refusing to recognise their trade union. As a consequence of this several transmission-line masts were blown up last week by means of dynamite. The union states that the outrages were the work of irresponsible individuals and offers to assist the company in patrolling the lines.

HYDRO-ELECTRIC DEVELOPMENTS.—The North Western Power Company, Ltd., brought into operation on July 15th the Seven Sisters Falls plant on the Winnipeg River on which upwards of £2,000,000 has been expended out of the estimated total of £4,700,000 to be invested on the complete project. The full output when attained will reach 225,000 h.p. The final installation at the Seven Sisters plant will consist of six units of 37,500 h.p. each, two of which are now in operation under a partial head, and developing 18,750 h.p. each. The third unit is expected to come into operation on September 1st, making a total of 56,250 h.p. under partial head. Under full head the same three machines, which constitute the initial installation, will produce 112,500 h.p. or 50 per cent. of the designed capacity.

The second hydro-electric plant, the opening date of which has been fixed for September 1st, is the Slave Falls plant close to the City of Winnipeg on the Winnipeg River. The City already operates a 105,000-h.p. plant at Pointe du Bois, but in 1929 began the construction at Slave Falls of another plant with a total designed installation of 96,000 h.p. The Slave Falls plant will eventually operate with eight 12,000-h.p. units, but the initial installation comprises two units together of 24,000 h.p. Power will be carried to Winnipeg by a transmission line 86 miles in length.

RURAL ELECTRIFICATION.—During last year 1,860 miles of additional primary electrical transmission lines were erected in rural districts of Ontario, and electrical service was given to 9,375 additional consumers in villages and on farms. At the end of 1930 the rural customers of the Hydro-Electric Power Commission of Ontario numbered 46,000, of whom over 21,000 are farmers. In addition to supplying electricity to 548 villages and townships, the Commission also supplies electricity in bulk to 26 cities and 94 towns

Clitheroe.—REDUCED CHARGES.—The Corporation Electricity Committee has adopted a reduced tariff for shop-window lighting, tubular heating, and a modified "all-in" scale for domestic consumers.

Derby.—YEAR'S WORKING.—In his annual report on the working of the Corporation Electricity Supply Department for the past year, Mr. F. Nicholls, borough electrical engineer, states that the revenue increased by £15,956 to £230,854, the working expenditure amounting to £108,078, as compared with £99,810 in 1929-30. The gross profit showed an increase from £115,089 to £122,776, to which was added income from other sources making a total of £124,916 available. From this the following items had to be met: Loan interest, £44,613; loan repayment, £43,781; income tax, £9,890; other items, £2,904. There thus remained a net profit of £23,728, which compares with £21,437 in 1929-30. During the year capital expenditure amounted to £73,493, the chief items being £22,398 for machinery and £36,432 for mains and services; the total capital expenditure at March 31st was £1,743,237. Electricity sold increased from 33,953,695 to 34,848,721 kWh, in spite of the fact that nearly 1¼ million kWh was sold in the previous year to the Derbyshire & Nottinghamshire Electric Power Co. under a contract which has now terminated. The maximum load reached 16,216 kW, in comparison with 16,892 kW in the previous year. New consumers numbered 1,868, making a total of 19,777 now connected. Work in connection with the linking up of the generating station to the grid is in progress and a new switchgear annexe is nearing completion.

Eastbourne.—HIRE-PURCHASE OF COOKERS.—The Corporation Electricity Committee has fixed five per cent. as a reasonable commission to pay to contractors who introduce customers for the hire-purchase of cookers. Payment is only to be made in respect of the hire-purchasers who are accepted by the Corporation after it is satisfied as to the financial stability of the applicants.

Glasgow.—YEAR'S WORKING.—We have received from Mr. H. Bell, general manager of the City Electricity Department, a copy of the statement of accounts of the undertaking for the year ended May 31st last. Owing to reductions in tariffs and a decrease in output, revenue showed a decline from £1,478,909 to £1,506,574. Working expenditure on the other hand rose from £575,316 to £620,557, the increase being due largely to increases of £32,625 in generating costs and £6,854 in rents and rates. There was a gross profit of £686,017 (£903,593), from which the following items had to be met: Interest on loans, £225,674 (as against £248,763 in 1929-30); loan redemption, £342,395 (£410,219); income tax, £90,826 (£21,701). There thus remained a net profit of £27,121, which compares with £222,910 in the preceding year. The gross capital expenditure for the year amounted to £172,817 (of which £50,462 was met out of revenue), the total now spent on the undertaking being £10,645,189. There was a decrease of nearly 27 million kWh in industrial power consumption, but energy sold for all other purposes showed a substantial increase; the total sales decreased from 251,035,240 to 237,770,666 kWh. The average price obtained per kWh fell from 1.41d. to 1.32d. The total maximum supply demanded increased from 312,822 to 325,476 kW, but the load factor fell from 30.35 to 29.91 per cent. During the year 10,813 new consumers were added, making the total connected at the end of the year 107,115.

MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £11,282.

ESTIMATES FOR 1931-32.—At the last meeting of the Committee, the city electrical engineer submitted an estimate of the revenue and expenditure of the Department for the year 1931-32 as follows: Revenue, £1,263,500; expenditure £1,202,900; leaving a surplus of £60,600. The Committee approved. The engineer also submitted an estimate of the capital expenditure for the year, amounting to £280,300, of which £120,300 is to be met out of loans, and £160,000 out of revenue. The Committee approved and recommended the Corporation to authorise the borrowing from time to time of £120,300.

PROGRESS OF SCHEMES.—Under the Electricity Department assisted wiring scheme 302 houses were wired in July, making the total to date 33,437. Hire appliances numbered 10, making the total to date 20,503.

Longtown (Cumberland).—CENTRAL SCOTLAND SCHEME.—At a recent meeting of the Rural District Council a communication was received from the Central Electricity Board, Glasgow, giving notice that the Board intended at the expiration of one month to execute the following works in connection with the Central Scotland Electricity Scheme: 33,000-V overhead lines between the Westbank power station and the municipality of Carlisle and the Gretna sub-station of the Dumfriesshire County Council; and 11,000-V lines between the power station and Rockcliffe. The Board asked permission to place overhead lines over lands in the Longtown rural area. It was decided to offer no objection to the scheme.

Manchester.—LOAN FOR DISTRIBUTION EQUIPMENT.—The Electricity Committee has obtained sanction to borrow £44,700 for transformers and switchgear.

Mid-Cumberland.—ELECTRICITY SCHEME.—The Mid-Cumberland Electricity Co. has been accepted as the distributing authority in connection with the Mid-Cumberland electricity scheme. The company has opened offices at Cockermouth. Three grid lines of the Central Electricity Board will pass through Cumberland and the entire coast from Silloth to Parton, excluding Workington, will be covered by the scheme. The Carlisle, Brampton, and Longtown rural areas are to be supplied by Carlisle Corporation.

New Zealand.—HUTT VALLEY ELECTRIC POWER BOARD.—In his report on the operation of the Board for the year ended March 31st last Mr. E. F. Hollands, engineer and manager, states that the total income (after allowing for discounts amounting to £5,275) was £106,315. After providing for all working and capital charges and contributing a sum of £1,000 to the Earthquake Relief Fund there remained a net profit of £10,535. Sales of electricity rose by nearly 39 per cent. to 19,612,820 kWh, the maximum load being 5,028 kW as against 4,320 kW in 1929-30. The number of consumers increased from 9,521 to 10,467. During the year a number of important works were carried out including the construction of a new transmission line to the western area through the Ngahauranga Gorge, the reconstruction of the Silverstream-Quinn's Post line and the completion of the new transmission line between Epuni and Melling sub-stations.

Newquay.—THE RIVER GANNEL SCHEME.—With regard to the River Gannel electrification scheme, which is being promoted by Sir M. Macdonald and Partners, a letter was read at a recent meeting of the Newquay Urban Council from the Board of Trade, stating that the Board was concerned only so far as the interests of navigation might be affected, but in view of the many other interests, both public and private, which were involved, and the possible restriction of the present and future exercise of the public right of navigation, the Board was of the opinion that preliminary powers should be obtained for the execution of the proposals of the scheme. Pending a grant of statutory powers the Board said it was unable to give its sanction to the scheme submitted. The Council decided to assist the promoters in any application which might be made to Parliament.

Northern Ireland.—LURGAN (CO. ARMAGH).—By a breakdown in the electrical plant, some 5,000 workers have been thrown out of work in the large linen manufacturing centre of Lurgan. Lurgan was to have been linked up with the Belfast scheme months ago but owing to departmental delays that has not been effected, although the management in Lurgan some weeks ago had foretold a possible breakdown. The crank shaft of the main engine broke when stripped for partial overhaul, and when the third engine was put into commission the air pressure failed. The main transmission lines and sub-stations have been completed and ready to be connected up since October last. As a temporary measure the Lisburn Electric Supply Co. is affording Lurgan a bulk supply; this was commenced the day after the breakdown.

Nottingham.—DOMESTIC PROGRESS.—The opening of a showroom by the Electricity Department has been amply justified. Within the last 18 months over 1,740 electric cookers have been connected under the Department's schemes.

Oldham.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. F. L. Ogden) for the year ended March 25th last show a total revenue of £247,324 and a working expenditure of £137,372, leaving a gross profit of £109,952. The preceding year's figures were: Income, £247,789; working expenses, £142,369; gross profit, £105,421. To the gross profit were added the balance from the previous year's account (£864) and income from various other sources (£25,350), making a total of £136,166 available. After providing for capital and other charges and transferring £864 to the reserve fund, there was a net surplus of £1,560, as compared with £864 in the preceding year. Capital expenditure during the year amounted to £227,930, the principal items being £75,446 for mains and £48,792 for the hire-purchase scheme; the total now spent on the undertaking stands at £2,121,280. The sales declined from 52,549,764 to 46,518,330 kWh, this being due to a fall of over 7 million kWh in power consumption. Energy consumed under the rateable value tariff totalled 2,392,846 kWh, more than double the quantity sold in the previous year. The maximum load decreased from 28,600 kW to 24,400 kW. For the whole supply the average price obtained per kWh was 1.236d., which compares with 1.107d. in 1929-30.

Peterborough.—SUPPLY TO THORNEY.—The Corporation Electricity Committee is negotiating with the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co. for a supply of electricity to Thorney and the district west of Peterborough.

Quarry Bank.—STREET LIGHTING.—A suggestion to substitute electricity for gas for the lighting of the streets is to be considered by the Quarry Bank Council.

Rawtenstall.—YEAR'S WORKING.—The accounts of the Corporation Electricity Department (engineer: Mr. C. L. E. Stewart) for the year 1930-31 record a total revenue of £59,333 and a working expenditure of £34,292, leaving a gross profit of £25,041. The figures for the preceding year were: Income, £60,063; working expenses, £30,249; gross profit, £29,814. After providing for capital and other charges, there was a net surplus of £202, as compared with £5,221 in the preceding year. Sales of electricity decreased from 14,173,358 to 13,784,746 kWh, the average price obtained per kWh falling from 0.996d. to 0.979d.

Southend-on-Sea.—PROMENADE ILLUMINATION.—The Town Council has received sanction to a loan of £9,894 for the lighting of the Promenade between the Kursaal and Shorefield Road, and the Electricity Commissioners have deferred consideration of the application in respect of the other two sections of the scheme pending the decision of the Unemployment Grants Committee with regard to the granting of financial assistance.

Stirlingshire.—EXTENSION OF SUPPLY.—The Grampian Electricity Supply Co. is to introduce electricity into the Killearn and Balfron districts of Stirlingshire.

Stoke-on-Trent.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £2,200 to provide an additional supply of electricity to the Trent Vale Brick and Tile Co., Ltd., at its works in Trent Vale.

The Committee is applying for sanction to a loan of £5,000 for the erection and equipment of a sub-station, mains, &c., in Hartshill.

Tynemouth.—CHARGES FOR WATER-HEATING.—The Corporation Electricity Committee has fixed the charges for electricity for water-heating at ¾d. per kWh for persons not on the residential tariff.

Wallasey.—YEAR'S WORKING.—An increase from £158,008 to £183,904 in revenue is recorded in the report on the working of the Corporation Electricity Department (engineer and manager: Mr. B. T. Hawkins) for the year ended March 31st last. Working expenses amounted to £102,015, as compared with £93,741 in the previous year, the gross profit rising from £64,216 to £81,889. Capital and other charges absorbed £48,146, as against £50,258, and there is a net surplus of £34,783 (£14,358). Sales of electricity increased from 47,102,430 to 53,699,254 kWh, and the maximum demand from 15,050 kW to 17,280 kW. The average price obtained per kWh was 0.785d., as compared with 0.761d. in 1929-30. A feature of the year was the success of the assisted wiring scheme introduced in April, 1930. As a direct result of the scheme, 4,091 new consumers were connected during the twelve months, in addition to 753 connected on consumers' own wiring; the total number of consumers of all classes at March 31st was 18,405. Considerable progress was also made in the sale of electrical appliances on hire-purchase terms, vacuum cleaners being added to the list of available articles in October last. Of the 652 appliances sold under the hire-purchase scheme during the year, 305 were vacuum cleaners, 205 radiators, 70 cookers and 56 kettles.

West Ham.—YEAR'S WORKING.—In spite of the prevailing industrial depression which has caused a considerable decrease in the consumption of electricity by industrial power users, sales of energy as a whole show an increase from 98,074,425 to 99,165,353 kWh, states Mr. J. Townley, borough electrical engineer and manager, in his annual report on the working of the electricity undertaking for the past year. The number of consumers connected during the year numbered 3,560, bringing the total at the end of the year to 19,410. The maximum load rose from 34,415 to 39,200 kW and the load factor from 32.53 to 34.63 per cent. For the whole supply the revenue per kWh was 1.00d., as compared with 0.98d. in the previous year, while the total revenue of the undertaking amounted to £419,280, as against £405,326. Working expenses increased slightly from £240,251 to £241,563, the gross profit totalling £177,718 (£165,075). To this was added income from other sources making a total of £185,325. Of this loan charges absorbed £136,018 (£117,143 in 1929-30), income tax £7,213 (£9,519) and special works £18,499 (£20,765), the net surplus being £23,595 (£27,879). During the year £225,681 was spent on capital account, the principal items being £98,934 for mains, £34,903 for assisted wiring installations and £32,450 for machinery and plant; the total capital expenditure on the undertaking is now £2,243,318, of which £1,020,638 has been repaid. Further progress was made with the reconstruction and replacement of the main e.h.p. switchgear at the generating station and it is hoped that the work will be completed during next year. A commencement was also made with the construction of a new control room adjoining the engine room. Much work was done in connection with extending and improving the distribution system and during the year thirteen new transformer sub-stations were built, equipped and put into use, two existing sub-stations were extended and additional transformers totalling 6,510 kVA installed. The new section of the new offices and showrooms was completed in November last, when the official opening ceremony included the inauguration of a new 30,000-kW turbo-alternator at the power station.

Traction

Argentina.—THE SUBWAY QUESTION.—The August *Review* published by the Bank of London and South America, Ltd., states that the extension of the Lacroze subway in Buenos Aires to Calle Carlos Pellegrini is now in public use, and is said to have added considerably to the traffic by this route. As regards other subway schemes the position is far from clear. A cable from Paris appeared in the Argentine Press towards the end of June, wherein it was stated that the Spanish concessionaires, known locally as the C.A.P.Y.C. group, had sold their rights to a British syndicate, but this was subsequently contradicted by the local directors of that undertaking, who declared that they had handed in their final plans to the municipal authorities and had every reason to expect that they would be able to begin work within the limit of time laid down in the concession.

Carlisle.—TRANSPORT AGREEMENT.—The Corporation General Purposes Committee has reached an agreement with the Carlisle and District Transport Co. with regard to the negotiations which have been taking place for the sale of the tramway undertaking and in particular the question of road reinstatement in the event of the abandonment of the system. The Committee has accepted the offer of the company to pay £3,500 to the Council, and to hand over the rails, electric cable ducts, poles, overhead equipment, &c., in consideration of the Corporation relieving the company from the liability of road reinstatement consequent upon the abandonment of the tramways.

Continental.—SWITZERLAND.—Rapid progress is being made with the electrification of the railway between Bodensee and Toggenburg. Plans for the electrification of the line between Huttwil and Wolhausen are now under consideration.

ITALY.—The Technical Committee of the Rome Metropolitan Railways is shortly to invite tenders for the construction of an underground railway to relieve the much-congested road traffic. This is a scheme that has been under consideration for a number of years, forming part of a general plan for transport facilities to accommodate a prospective city population of 2,000,000. The present central railway station will be demolished and entirely rebuilt underground; two new stations for passenger traffic will be built, the three then being connected by an underground electric railway. The scheme provides for six lines serving the capital, three being for construction in the immediate future. One will have a length of 10.3 km. and is estimated to cost £3,000,000. The hub for the lines will be the Central railway station, through which wmost of them will pass. The total length of new construction involved in the six lines is 56 km., of which 24.4 km. are included in the lines for future construction. This part of the plan will require 12 to 15 years for completion. The proposed lines will carry the heaviest traffic first, with gradual additions to the system until it is capable of serving the whole population.—*Reuter's Trade Service.*

A narrow-gauge electric railway is in course of construction between Rimini and San Marino, a distance of 20 miles. The line will be operated at 3,000 V d.c., energy being supplied from a sub-station at Dogana where Brown-Boveri converting plant is being installed.

Great Western Railway.—COLOUR-LIGHT SIGNALS.—On Sunday last colour-light signals were put into operation at the Subway Junction signal box near Paddington. This is the initial part of a system of colour-light signals which is being installed between Paddington and Southall at a cost of about £60,000. It is anticipated that the scheme will be completed early next year.

Siam.—DIESEL-ELECTRIC TRACTION.—As an experiment the Siamese State Railways have ordered 13 Diesel-electric locomotives from Continental manufacturers. If these are successful it is intended to increase their number as a means of speeding up and relieving the congestion on the State Railways.

South Africa.—FUTURE OF DURBAN TRAMWAYS.—The question whether Durban shall abandon the tramway system and substitute railless cars or heavy-oil engined omnibuses is being debated at the local Council elections. Councillor Elgie, deputy-chairman of the Tramways Committee, who has been inspecting various types of transport in England, has just returned to South Africa favourably impressed with the heavy oil-engine omnibuses.

Telegraph and Telephone

Continental Telephony.—INCREASE IN "PERSONAL" CALLS.—No fewer than 7,675 British telephone subscribers who rang up the Continent during July used the "personal" call system, according to figures issued by the Post Office on August 22nd. This is an increase of 3,264 or nearly 100 per cent. over July last year and of 1,092 over June this year. Under the "personal" call system the telephone authorities find the person to whom it is desired to speak or, if the person cannot be found, the subscriber is only charged a small fee.

Telephone Development. — POSITION IN THE PRINCIPAL COUNTRIES.—According to figures quoted by *Reuter* (New York), the latest survey indicates that there were 34,526,629 telephones in the world on January 1st, 1930. Of these, the United States possessed 20,068,023, or 58 per cent. of the total. Europe, with 10,035,580 telephones on the same date, had 29 per cent. of the world's total, or one-half as many as the United States, the remaining 13 per cent. of the telephones being distributed widely throughout the rest of the world. More than two-thirds of the world's telephones are operated by privately-owned systems, due to the relatively heavy American development. In the United States all telephones are operated by private companies, and that country not only has more telephones than all the rest of the world but also leads in the number of telephones relative to population. The United States with 16.4 telephones for each 100 of its people has nearly nine times the relative telephone development of Europe, which has only 1.9 telephones per 100. Canada, with 14.2 telephones per 100 population, is the only country whose telephone density approaches that of the United States. New Zealand takes third place with 10.3, followed by Denmark with 9.6, Sweden with 8.3, and Australia with 7.9 telephones per 100 population.

Egypt. — TELEPHONE CONVERSION. — The local telephone exchange systems at Port Said and Suez are to be converted to automatic operation.

Italy.—ANOTHER MARCONI EXPERIMENT.—The *Daily Telegraph* states that on the occasion of the festivities to be held in Brazil in next October to celebrate the discovery of America, the Marchese Marconi is to set in motion from his yacht, the *Elettra*, in Italian waters, a chain of relays which will terminate some 5,000 miles away at Rio de Janeiro. The rays will operate an electric switch to light a powerful beacon. This experiment is similar to the one which he carried out last year when an electrical-impulse sent out from the *Elettra* was received, amplified, and re-transmitted by a British beam station to Sydney, Australia, giving the signal for the illumination of the Electrical Exhibition.

South Africa.—GOVERNMENT AND DURBAN TELEPHONES.—The Durban Town Council, after considering a notice from the Government that it would take over the telephone system on January 31st next, has decided to leave the matter in the hands of Mr. Graham Mackeurtan, K.C., standing counsel, to take the matter up with the Government and to recommend some line of action to the Council as soon as possible. The Council is afraid that the Government will take over the system before a price is fixed. A suggestion for arbitration was rejected as an expert would have had to be brought from overseas, causing more delay.

NATAL LINKED WITH CAPE TOWN.—On July 29th 49 additional towns in South Africa were connected with the trunk service at Cape Town and for the first time Natal was connected to Cape Town. This extension of long-distance facilities has become possible by the installation of repeater apparatus at Johannesburg. Hitherto, Pretoria has been the furthest point within telephone reach of Cape Town.

Radio

Germany.—OPENING OF NEW BROADCASTING STATIONS DELAYED.—The new high-power broadcasting stations at Frankfurt, Breslau and Leipzig are not expected to be ready for operation until next February.

HIGH-POWER TRANSMITTERS. — *World-Radio* states that the Bavarian high-power transmitter has been ordered from makers in Berlin. It will be quartz crystal controlled and will have a power of 75 kW, which can easily be increased to 150 kW. The new Leipzig transmitter will have a power of 150 kW at the outset. This is also being built in Berlin.

RADIO EXHIBITION.—Complete short-wave transmitting and receiving sets, improved loud-speakers, and an average price-cut of 25 per cent. are the features of the annual German Radio Exhibition which opened in Berlin on August 21st. The exhibition, which is claimed to be the largest of its kind in Europe, is housed in eight large halls surrounding the famous Witzleben Wireless Tower. Makers of talking-picture apparatus are amongst the 325 firms which, despite the financial and economic crisis, have exhibits at the show. There is a large array of radio-gramophones, ranging from luxurious sets incorporating moving-coil speakers, to the less pretentious types.—*Reuter* (Berlin).

Italy.—RADIO EXHIBITION.—The third annual Italian National Radio Show is to be held in Milan from October 10th to 18th next.

Londonderry.—AERIALS ACROSS STREETS.—At last week's meeting of the Corporation an application was made for permission to erect a wireless aerial across a street. It was asked if many such applications had been received and granted and the Town Clerk said that a considerable number of aerials had been erected across streets without permission. The people responsible were liable to prosecution and a penalty and he had advised the present application so that the matter should be ventilated for the information of the public.

United States.—LARGE NUMBER OF LISTENERS.—About 10,000,000 homes in the United States, one-third of the total in the country, are equipped with radio sets, according to the Census Bureau, quoted by *Reuter's* Washington correspondent. In the first quarter of 1931, 70,000 American radio sets were marketed abroad, as compared with 41,000 in the same period last year. About 26,000,000 sets are now in service all over the world. Great Britain and Germany have about 2,500,000 receiving sets each and France has about 1,250,000. The United States, with 83 sets for each thousand of population is the largest radio user. Denmark, with 63 sets per thousand is second, and Sweden, with 60 sets per thousand is third.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Cranwell (Lincs.).—H.M. Office of Works. September 17th. Electric wiring at the R.A.F. College. (See this issue.)

Edinburgh.—September 2nd. Corporation. Installation of electric power mangles (14) at various Corporation wash-houses. Specifications, &c., from Mr. E. J. MacRae, city architect; tenders to town clerk.

Egypt (CAIRO).—October 8th. Prison Administration. Diesel engine driven generator for Abu Zaabal power station. (A.X. 11055.)*

October 28th. Department of Public Health. Electro-medical and X-ray apparatus for six months commencing November next. (A.X. 11069.)*

December 2nd. Ministry of the Interior. Complete power station for the town of Tantah. (A.X. 11066.)*

September 23rd. Ministry of Public Works. One 12 kW internal combustion driven generating set for the hospital at El-Tayeba. (A.X. 11084.)*

Farnworth.—September 5th. Electricity Department. House service type meters. (August 14th.)

Fife.—September 15th. County Council. Electric lighting at Kirkcaldy West School. Schedules (deposit £1 1s.) from Mr. G. Sandilands, architect, Education Offices, Kirkcaldy.

Hastings.—September 8th. Electricity and Public Lighting Committee. Overhead and underground lines. (August 14th.)

Irish Free State.—CLONAKILTY, CO. CORK.—West Cork County Board of Public Assistance. Installation of electric lighting at County Home. Particulars from Mr. J. J. O'Crowley, architect, Secretary's Office, County Home, Clonakilty.

FERMOY, CO. CORK.—North Cork Board of Public Assistance. Installation of electric lighting in County Hospital. Particulars from the engineer, County Home, Mallow, Co. Cork.

Leicester.—September 1st. Corporation. Laundry equipment, including laundry machinery, power transmission gear, electric power and wiring, at the Swain Street Institution. Specification and form of tender (deposit £2) from Mr. A. T. Gooseman, city engineer and surveyor, Town Hall.

London.—BETHNAL GREEN.—August 31st. Borough Council. H.p. and l.p. cables. (August 14th.)

August 31st. H.p. switchgear and electrical installation work. (August 21st.) (This item was inadvertently placed under "Central Electricity Board" in our last issue.)

CENTRAL ELECTRICITY BOARD.—September 21st. Construction of site works, foundation works, &c., at Agecroft, Clarence Dock, Crewe, St. Helen's, Blackburn and Nelson. (August 14th.)

September 21st. Construction of site works, foundation works, &c., at Oxford, Gloucester, Bourne Valley, Swindon, Newport and Plymouth. (August 21st.)

LONDON COUNTY COUNCIL.—September 16th. Wiring and fittings for public staircases, &c., at Boundary Street estate, Shoreditch and Bethnal Green. (See this issue.)

September 21st. Wiring and fittings at St. James's Hospital, Balham. (See this issue.)

OFFICE OF WORKS.—September 15th. Electrical and mechanical engineering labour in Cardiff. (August 21st.)

METROPOLITAN WATER BOARD.—September 17th. Switchboard for two 200-kW and one 50-kW generators at Surbiton pumping station. (See this issue.)

Manchester.—August 29th. Electric hospital bed lift at Withington Hospital, Nell Lane, West Didsbury. Specification from the superintendent of works, Public Assistance Offices, All Saints, Manchester.

Milngavie.—Town Council. Electric lighting of housing scheme. Schedules from Mr. F. A. B. Preston, L.R.I.B.A., housing architect, 6, Buchanan Street, Milngavie (deposit £1 1s.).

New Zealand.—WELLINGTON.—Post and Telegraph Department.

November 19th. New Zealand Railways. Intercall telephone system between Christchurch and Invercargill. (A. 11060.)*

Public Works Department. October 20th. Boosting transformers. (A.X. 11046.)*

November 17th. Four 3,333-kVA oil-immersed self-cooled transformers. (A.X. 11079.)*

Oldham.—September 17th. Public Assistance Committee. Electric lamps required at the Institution, Rochdale Road. Specification from Public Assistance Officer, Public Assistance Offices, Rochdale Road.

Oswestry.—September 5th. Electricity Department. Cables, switchgear, transformers, &c. (August 21st.)

Plymouth.—September 14th. Electricity Department. E.h.p. metal-clad switchgear. (August 21st.)

Portsmouth.—September 9th. Electricity Department. Cables (August 14th.)

Reigate.—September 5th. Corporation. Automatic traffic control signals. (August 14th.)

Rossington (near Doncaster).—September 5th. County Council. Electric lighting installation at new police station. Particulars from the West Riding architect, County Hall, Wakefield.

South Africa.—CAPE TOWN.—September 16th. Oil-immersed capacitor and an automatic oil circuit breaker. (A.X. 11052.)*

PRETORIA.—September 25th. Town Council. Sub-station switchgear. (A.X. 11075.)*

September 18th. Switchgear and auxiliary apparatus required in connection with the installation of one, or alternatively two, 12,500-kW sets. (A.X. 11037.)*

BENONI.—Municipal Council. September 17th. H.p. and l.p. cables, boxes and transformers, and h.p. testing equipment. (A.X. 11076.)*

DURBAN.—September 25th. Corporation. 33-kV outdoor switching equipment. (A.X. 11082.)*

Sunderland.—September 14th. Corporation. Cable, wire, meters and lamps. (August 14th.)

Wakefield.—August 29th. West Riding County Council. Wiring for electric lighting at the County Hall. Specifications from the county architect, County Hall.

Installation of internal automatic telephones in the new Registry of Deeds. Particulars from county architect, County Hall.

West Ham.—September 14th. Education Committee. Installation of electric lighting at South Hallsville Senior, Cheshunt Road and Pretoria Road Schools, now in course of erection. (August 14th.)

Wick.—September 7th. Electricity Department. Boiler plant, turbo-alternator, condensing plant, rotary convertor, h.p. and l.p. switchgear, and accessories. (August 21st.)

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Barking.—Urban District Council. Accepted:—
Electrical installation in Erkenwold Schools.—Alpha Mfg. and Electrical Co., Ltd.

Dundee.—Education Committee. Accepted:—
Electric lighting of new school (£762).—R. Kilpatrick & Co.

Gainsborough.—Urban Council. Accepted:—
Electrical fittings for the Town Hall buildings.—Ingram and Kent, Ltd.

Glasgow.—Education Committee. Accepted:—
Electric lighting at Victoria Drive School (£88) and at St. Mark's School (£60).—R. J. Sinclair (Glasgow), Ltd.
Electric lighting and heating at Carnwadrie School (£442) and electric lighting at St. Agnes' School (£75).—D. Hendersen.
Electric clocks and bells at Albert School (£116) and at Hillhead School (£92).—Edward & Son, Ltd.
Housing Committee. Recommended:—
Electrical installations in 726 houses at West Drumoyne estate (£2,765).—R. J. MacIntyre.
Electrical installations in houses on Cottar Street estate (£492).—F. M'Creafy.
Transport Committee. Accepted:—
Feed water pump for Pinkston.—Drysdale & Co., Ltd.
Copper trolley wire.—British Insulated Cables, Ltd.; I.C.I. Metals, Ltd.
Coils for magnetic brakes.—Metropolitan-Vickers Electrical Co., Ltd.; Electro-Mechanical Brake Co., Ltd.
Lead-covered cable.—Standard Telephones & Cables, Ltd.
Finance Committee. Accepted:—
Electrical installations: Pollokshaws Hall (£51), Haddow and Co., Ltd.; Kingston Hall (£421), R. J. Sinclair (Glasgow), Ltd.; and Langside Hall (£424), T. B. and J. A. Mathieson, Ltd.

Government Contracts.—The following contracts were placed by the various Government Departments during July:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).
Petrol-electric cranes.—Ransomes & Rapier, Ltd.
Ship-ventilating fans.—Laurence, Scott & Electromotors, Ltd.; Mawdsley's, Ltd.; Small Electric Motors, Ltd.; W. H. Allen Sons & Co., Ltd.; Veritys, Ltd.
Fuse carriers.—Bertram Thomas.
Switchgear.—Ferguson, Pailin, Ltd.
Switchboards and spare parts.—Whipp & Bourne, Ltd.
Automatic telephone exchange extension.—Siemens Bros. and Co., Ltd.
Silica w.t. valves.—Mullard Radio Valve Co., Ltd.

WAR OFFICE.
Batteries and cells.—Siemens Bros. & Co., Ltd.; Ever Ready Co. (G.B.), Ltd.; India Rubber, Gutta Percha & Telegraph Works Co., Ltd.

AIR MINISTRY.
Batteries and accumulators.—C. A. Vandervell, Ltd.; Chloride Electrical Storage Co., Ltd.; Peto & Radford, Ltd.
Generators and generator windmills.—Haslam & Newton, Ltd.

CROWN AGENTS FOR THE COLONIES.
Cables.—British Insulated Cables, Ltd.; Siemens Bros. and Co., Ltd.
Copper wire.—T. Bolton & Sons, Ltd.
Generating sets.—A. Lyon & Co.
Insulators.—Bullers, Ltd.
Lighting outfits.—J. Stone & Co., Ltd.
Telephone repeaters.—General Electric Co., Ltd.
X-ray apparatus.—Schall & Sons.

POST OFFICE.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Ericsson Telephones, Ltd.; General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Telephone Manufacturing Co. (1929), Ltd.
Radio apparatus.—International Marine Radio Co., Ltd.; Rees-Mace Manufacturing Co., Ltd.
Cable.—Connollys (Blackley), Ltd.; Standard Telephones and Cables, Ltd.
Secondary cells.—Accumulators of Woking, Ltd.
Charging sets.—New Pelapone Engine Co., Ltd.
Loading coils.—General Electric Co., Ltd.; Siemens Bros. and Co., Ltd.; Standard Telephones & Cables, Ltd.
Telephone cords.—Siemens Bros. & Co., Ltd.
Electric light fittings.—Revo Electric Co., Ltd.

Insulators.—Bullers, Ltd.
Copper wire.—I.C.I. Metals, Ltd.
Cabling, loading coils and terminations (Belfast-Donaghadee; Ayr-Stranraer; Stranraer-Port Kail & Knock Bay).—Pirelli-General Cable Works, Ltd.
Lighting and power wiring (Mayfair automatic exchange).—Pinching & Walton.
Telephone exchange equipment.—Manchester Telephone Service (Manchester area); Tandem (London, W.C.); Leeds; Blackburn; Nottingham Central; National (London, E.C.); Primrose (London, N.W.); Monument (London, E.C.); Holborn (London, W.C.); Metropolitan (London, E.C.); Bishopsgate (London, E.C.); Southport (Lancs.); Blackfriars (Manchester); Manchester Tandem: Automatic Telephone Manufacturing Co., Ltd. Sheffield Central; Maida Vale (London, W.); Pollards (London, S.W.); Springfield (Birmingham area): Siemens Bros. & Co., Ltd. (Sub-contractors for Springfield: Chloride Electrical Storage Co., Ltd., for batteries; English Electric Co., Ltd., for charging machine; Crompton Parkinson, Ltd., for ringing machines.) Portslade (Brighton multi-office area): Siemens Bros. & Co., Ltd. (Sub-contractors: Hart Accumulator Co., Ltd., for batteries; Electric Construction Co., Ltd., for motor-generator; Crompton Parkinson, Ltd., for ringing machines). Blackheath (Birmingham area): Siemens Bros. & Co., Ltd. (Sub-contractors: Hart Accumulator Co., Ltd., for batteries; English Electric Co., Ltd., for motor-generator). Wolverhampton; Bilston (Wolverhampton multi-exchange area); Pinner (Middlesex): Standard Telephones & Cables, Ltd. (Sub-contractors for Wolverhampton, Bilston and Pinner: Chloride Electrical Storage Co., Ltd., for batteries; Electric Construction Co., Ltd., for motor-generator sets and ringing machines). Welbeck (London, W.); Fulham (London, S.W.); Rochdale; Temple Bar (London, W.C.); Sloane; Bermondsey; Southend-on-Sea; Newcastle Central: Standard Telephones & Cables, Ltd. Moss Side (Manchester); Linthorpe (Middlesbrough); Birmingham (Victoria): General Electric Co., Ltd.
Telephonic repeater equipment (Newcastle-on-Tyne, Jedburgh and Edinburgh).—Standard Telephones & Cables, Ltd.

Lamp Contracts.—The G.P.O. has placed contracts with the Edison Swan Electric Co., Ltd., for the supply of carbon filament lamps, and the British Thomson-Houston Co., Ltd., for the supply of vacuum and gasfilled lamps for twelve months from September 1st next.

Leeds.—Waterworks Committee. Accepted:—
Electric booster pumps at Bramley (£411).—Harland Engineering Co., Ltd.

Liverpool.—Mersey Docks and Harbour Board. Accepted:—
Electric cable.—British Insulated Cables, Ltd.
Motor-generator sets, &c.—British Thomson-Houston Co., Ltd.

London.—WANDSWORTH.—Borough Council. Accepted:—
Electrical installation at new Clapham Baths.—Alpha Mfg. and Electrical Co., Ltd.

Manchester.—Paving Committee. Accepted:—
Automatic traffic control signals.—Messrs. Chance Bros. and Co., Ltd., Smethwick, and Revo Electric Co., Ltd., Tipton.
Health Committee. Accepted:—
Automatic telephone system at Abergele sanatorium.—General Electric Co., Ltd.
Electricity Committee. Accepted:—Supplies for 12 months:—
Current transformers.—Ferranti, Ltd.
Time switches.—Nathan & Allen, Ltd.; Venner Time Switches, Ltd.
A.c. meters.—Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Measurement, Ltd.
Electric kettles.—Premier Electric Heaters, Ltd.
Cable supplies.—Derby Cables, Ltd.; Metropolitan Electric Cable & Construction Co., Ltd.; Connollys (Blackley), Ltd.; Hackbridge Cable Co., Ltd.; Macintosh Cable Co., Ltd.; W. T. Glover & Co., Ltd.; Power and Lighting Cables, Ltd.; Croydon Cable Works, Ltd.; Edison Swan Cables, Ltd.; Johnson & Phillips, Ltd.; Standard Telephones & Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; British Insulated Cables, Ltd.; Liverpool Electric Cable Co., Ltd.; Siemens Bros. & Co., Ltd.; Mersey Cable Works, Ltd.; L. Andrew & Co.; Pirelli-General Cable Works, Ltd.; Ward & Goldstone, Ltd.
Electric motors.—Asea Electric, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Laurence, Scott & Electromotors, Ltd.
C.i. junction boxes and socket bends.—A. & W. H. Bury, Ltd.
Street lanterns and globes.—Revo Electric Co., Ltd.; Butterworth Bros., Ltd.
Tinned steel binding wire.—Rd. Johnson, Clapham & Morris, Ltd.
Insulating cloth.—Ioco Rubber & Waterproofing Co., Ltd.
Dry batteries, &c., for flash lamps.—Siemens Electric Lamps and Supplies, Ltd.; Ever Ready Co. (Great Britain), Ltd.
Automatic protective gear, Barton station.—A. Reyrolle and Co., Ltd.
33,000-V sub-station switchgear.—Ferguson, Pailin, Ltd.

Mitcham.—Joint Hospital Committee. Accepted:—
Electrical installation at Wandle Valley Hospital.—Alpha Mfg. and Electrical Co., Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Electrical apparatus in the area north of London Road in connection with the change-over (£1,078).—William Jay, Ltd.

Stirling.—Town Council. Accepted:—
Electrical work for the Raploch rehousing scheme (£530).—A. Brewster.

Stoke-on-Trent.—Electricity Committee. Accepted:—
Overhead wiring and services on housing estates (£1,266).—Barnett & Soans.

Forthcoming Events

International Illumination Congress.—September 1st-3rd, London. September 3rd-5th, Glasgow. September 5th-8th, Edinburgh. September 8th, Buxton. September 9th, Sheffield. September 9th and 10th, Buxton. September 10th-12th, Birmingham. September 13th-18th, Cambridge. September 19th, London.
September 1st—October 3rd. 9 p.m. to midnight each day. Illumination of principal London buildings (see p. 326).

New International Association for Testing Materials.—September 6th-11th. Meeting at Zurich.

Institute of Marine Engineers.—Tuesday, September 8th. Institute, the Minories, E.C.3. 6 p.m. Presidential address, by Mr. F. E. Rebbeck.

Institute of Metals.—September 13th-18th, Zurich. Autumn meeting.

Royal Institution.—September 19th-25th. London. Faraday celebrations.

Institution of Electrical Engineers.—September 22nd-25th. Kingsway Hall, W.C. Summer meeting and Faraday celebrations. Royal Albert Hall. Conversazione and Faraday Exhibition.

British Association.—September 23rd-30th. Centenary meeting. September 23rd. Albert Hall, 3 p.m. Inaugural meeting. Central Hall, Westminster, 9 p.m. Presidential address by Gen. the Rt. Hon. J. C. Smuts.

Electrical Power Engineers' Association.—September 26th. Holborn Restaurant, W.C. Annual dinner.

Iron and Steel Institute.—September 29th—October 1st. Swansea. Autumn meeting.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following:—

"LAMPLOUGH" daylight colour-matching units.
O.K. electric vacuum cleaner.
UNIVERSAL interchangeable and replacement flat iron heating element.

Notes

Fifty Years Ago!

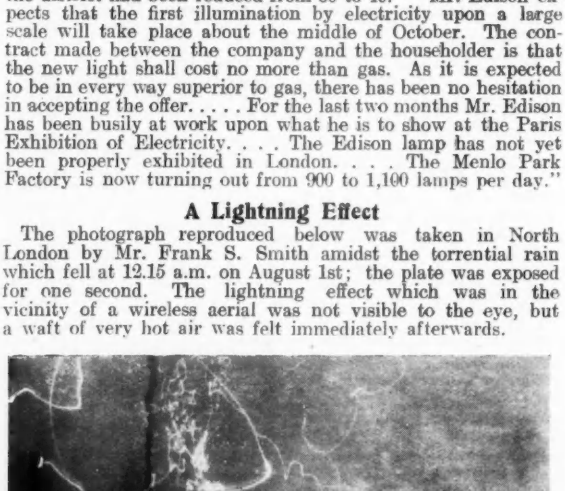
President Garfield.—In our issue of August 15th, 1881, the ELECTRICAL REVIEW congratulated the late Prof. D. E. Hughes upon the success of the method suggested by him for localising the bullet in the body of President Garfield. A description of the experiment, with diagram, was given.

Stored up!—Experiments with stored-up electricity had been conducted in the presence of professors, members of the administration, &c., at the Academy of Buda-Pest. "It is said to have been proved that electricity can be stored up just as well as light, gas, steam, &c., and that it can be transported in this state." The experiment was conducted with 50 Faure accumulators. "With these accumulators and with the help of a Gramme machine, a circular saw was set in motion and several logs of wood were cut up."

Edison Busy.—The Edison Electric Light Co. had almost finished its work in its first district in New York—having already wired 500 houses, and the number of men at work in the district had been reduced from 80 to 40. "Mr. Edison expects that the first illumination by electricity upon a large scale will take place about the middle of October. The contract made between the company and the householder is that the new light shall cost no more than gas. As it is expected to be in every way superior to gas, there has been no hesitation in accepting the offer. . . . . For the last two months Mr. Edison has been busily at work upon what he is to show at the Paris Exhibition of Electricity. . . . The Edison lamp has not yet been properly exhibited in London. . . . The Menlo Park Factory is now turning out from 900 to 1,100 lamps per day."

A Lightning Effect

The photograph reproduced below was taken in North London by Mr. Frank S. Smith amidst the torrential rain which fell at 12.15 a.m. on August 1st; the plate was exposed for one second. The lightning effect which was in the vicinity of a wireless aerial was not visible to the eye, but a waft of very hot air was felt immediately afterwards.



Oil-electric Traction

Proposals for the use of a Diesel-electric system of railway electrification have been laid before the Minister of Transport. It is claimed that by the sponsors of this system that the capital expenditure on this form of electrification would be only £150,000,000 instead of the £340,000,000 estimated in the Weir Report.

Supply in the Weald

Last week we published an account of the undertaking of the Weald Electricity Supply Co., Ltd. We are now able to state that arrangements have been made to take a supply from the Central Electricity Board at the end of the year at Hellingby for the purpose of supplying the southern part of the area.

The latest figures show that the hired wiring scheme introduced two months ago has met with instant success, 200 cottages having been obtained in the first six weeks. The rent of the installation, in the case of cottages, is included in the slot-meter rate per kWh. The number of consumers on the two-part tariff is 80 per cent. of the total, and these constitute 50 per cent. of the inhabitants on the routes of the mains, the total length of which is to date 305 miles; a further 16 miles is being laid. As protection for the 400/230-V cables a strip of steel tape is laid approximately 9 in. above the cable. The number of sub-stations is now 125. The maximum demand last year was 1,083 kW and not as stated in the previous article. It should also be mentioned that the official service contractors of the company must be members of the E.C.A. as well as on the National Register.

B.S.S. for High-voltage Bushing Insulators

The British Engineering Standards Association has recently issued the above British Standard specification, dealing with bushing-type insulators for indoor and outdoor use, including cable-terminating bushings, suitable for the range of declared voltages from 600 volts to 200 kV. In general arrangement, the specification is similar to the B.S. Specification No. 137-1930, dealing with insulators for overhead lines, but an important difference will immediately be noticed, namely, that the "rating number" assigned to each bushing is equal to the voltage, expressed in kV, used in the one-minute dry test, whereas in B.S.S. 137 the rating numbers are based on the voltage used in the 30-second rain test. For this and other reasons it is clearly stated in the specification that it must not be assumed that for a given transmission system the same, or nearly the same, rating number will represent both the appropriate bushing and line insulator. Each rating number is associated with certain test-voltages (one-minute dry test for indoor and outdoor bushings, 30-second wet test for outdoor bushings, and minimum dry flash-over voltage for indoor and outdoor bushings) and information regarding the selection and application of bushings is given by means of notes and "bushing selection tables."

Copies of this specification (B.S.S. No. 223-1931) may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s 2d. post free.

South African Telephone Progress

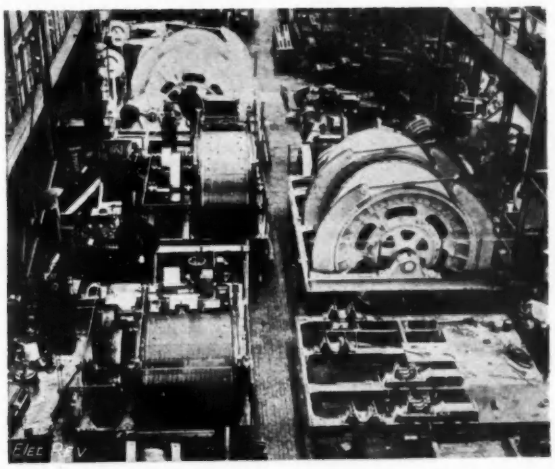
Statistics compiled by the Postmaster-General show that there are now 88,406 telephones rented by subscribers in the Union of South Africa, not including 15,644 farm line telephones and 5,743 call offices. In the last financial year the number of calls made was estimated at 159,351,725, of which town and city dwellers made 141,420,708 and farm residents 10,031,902, the balance of 7,899,115 being accounted for by calls from public offices. The number of trunk calls made was 11,210,088, representing just over six per cent. of the total. These figures mean that in five years the number of telephones in use in the Union has increased by 40 per cent., and that approximately 94 telephone conversations a year per head of the European population are made, as compared with only 32.1 in England. Johannesburg, among the principal cities, has the greatest number of telephones installed, the figure being 23,352. The Capetown district follows with 17,449.

Winders for the "Five-year Plan"

A series of six electric winding engines for the U.S.S.R. have just been completed by Messrs. Clarke, Chapman & Co., Ltd. All six have cylindrical drums and are driven by motors of from 60 to 320 h.p. Two of the winders are for No. 6 and 7 shafts at Prokopievskaya. The winding depth in each case is 72.8 m. The winding takes place to one level, two single-deck cages being in use. The cages are used for winding both men and coal, the maximum load being 8,150 kg. The winding rope is 32.5 mm. in diameter, and no balance rope is employed. The headgear pulleys have a diameter of 3 m. This winder, which is double drummed, the parallel drums being 3,000 mm. in length by 1,400 mm. in diameter, is driven through double-reduction gearing by one 40-h.p., 570-r.p.m. motor operating direct at 6,000 V, 3-phase, 50 cycles. The brakes are of the post type and are applied by a single foot lever.

The Leninskaia A. Shaft is to be equipped with a 320-h.p. skip winder which is fitted with an air brake and also a 120-h.p. cage winder. The latter gear has a single drum, 3,000 mm. by 1,100 mm., to wind a maximum load of 2,600 kg. The rope, which is 29 mm. in diameter, is unbalanced, whilst the cage is balanced by means of a counter weight. This cage has a single deck and is used to wind from levels 87 m. and 137 m.; 30 winds per hour can be obtained. The winder is driven by an asynchronous motor through double-reduction gearing.

A small winder for the Novo-Jurinskaia Shaft operates through a winding depth of 71 and 149 m. The single-deck cage is balanced by a counter weight, although the rope is unbalanced. The maximum load is 3,200 kg., 24.3 winds per hour being obtainable. There is one cylindrical drum 2,000 m. by 1,500 m. A double-drum 130-h.p. winder is destined for the



Alyk Shaft. This shaft is 250 m. deep, and the gear is designed to obtain 48 winds per hour. The electrical equipment for the Clarke Chapman winders has been supplied by the General Electric Co., Ltd.

An Insulating Material from Sugar

After nearly 40 years of research and experimental work Mr. Arthur S. Ford, an English chemical engineer now practising in New York, claims to have succeeded in transforming sugar into a novel plastic substance ideally suitable for the manufacture of electrical insulators; from the same material the inventor has also produced synthetic rubber and optical "glass."

The material is the result of his discovery of a process of polymerising sugar, and is said to be produced at a very low cost. The raw material can be either cane or beet sugar in any stage of refinement, treacle, dextrose, levulose, molasses, or even raw sugar cane. Treated in one way, the raw material condenses into a hard, glasslike mass; in another, it becomes a transparent substance with rubberlike properties; and a third variation of the process converts it into a brilliant celluloid. It is estimated that, at the present price of sugar, the substance can be produced for about 4¾d. per pound. This cost can be considerably reduced by combining the material with cellulose nitrate and cellulose acetate, thus making a non-inflammable product.

When the substance is first prepared it is a thick, highly viscous, elastic mass, which can be placed in solution for lacquers, can be poured into moulds to set, can be die cast, or it can be processed further into elastic rubbery sheets which take a brilliant polish. This "sakaloid" has an absolutely water-white transparency, with the appearance of the clearest crystal. This clarity permits the widest latitude of colour, a drop of concentrated dye in the mix resulting in a perfectly distributed tint.

Sakaloid can be obtained in both hard and soft forms. The former, which is used as an insulator, is translucent to violet and infra-red rays, and can be drawn, sliced, machined, or drilled. From hard sakaloid a moulding powder is made which, when hot pressed, flows and forms like "Bakelite." Once an insulator has been moulded from this material it ceases to be thermoplastic, heat serving only to harden it further. It gives off no gases on exposure to flame, and will not support flame, but simply chars when the heat becomes too intense.

Commercial production of the new material, it is reported, is expected within a few weeks, a large American chemical corporation having interested itself in the invention, and sugar refiners expect it to provide an appreciable outlet for the enormous surplus supplies of sugar now on the market.

Educational

In this issue the Northampton Polytechnic Institute, St. John Street, E.C.1, announces the commencement on September 21st of evening classes in engineering, optics, chemistry and other subjects.

National Coal Resources

Publication No. 19 of the Physical and chemical survey of the national coal resources series issued by the Department of Scientific and Industrial Research (H.M. Stationery Office, 2s. 6d. net) deals with the Lower Mountain mine of the Burnley, Accrington, Darwen and Bacup area of the Lancashire coalfield. It gives the results of a comprehensive and detailed examination, from floor to roof, of eighteen complete sections of the seam taken at different points well distributed over the area, in addition to three "strip" samples and two "run-of-mine" samples taken for purposes of comparison with the seam sections. The work was carried out for the Department by the Lancashire and Cheshire Coal Research Association. In addition, the report embodies the results of a

microscopical examination of the whole thickness of each of the eighteen sections, carried out by Mr. James Lomax of the Palæobotanical Section of the Association.

The seam varies considerably in thickness, from 1 ft. 3 in. to 3 ft. 4 in. where single, and from 2 ft. 6 in. to 4 ft. 8 in. where united with the Upper Foot mine. In general the seam has a very low phosphorus content and, on account of its high coking qualities, the coal is used extensively for the preparation of high-class metallurgical coke in ovens of both the by-product and beehive types; the coke produced has a very low sulphur content, but only the true Lower Mountain mine is used for this purpose, the amount of sulphur in the Union mine being too great. The coal is also used, either alone or mixed with less strongly coking coal, for general industrial purposes, gas manufacture and as a domestic fuel. The floor of the Lower Mountain mine is of fireclay, in some districts of excellent quality.

Economic Aspects of Air Preheating

The following is the summary of an interesting article under the above heading, by C. S. Darling, Whit. Ex., published in the *Power Engineer*. While air preheating is valuable in maintaining furnace efficiency, it cannot be regarded as a great gain at little or no cost. Actually it costs something. The fixed charges plus the running costs of the regenerative equipment must be charged against the preheated plant. Further it is the value of the heat recuperated which is of utmost importance and the heat potential should be maintained during the flow to the furnace as efficiently as possible. Air preheating systems improve steam generating plant from two points of view: (i) better combustion efficiency and overall boiler efficiency; (ii) provide means of obtaining cheaper and more efficient boilers. It is essential that the insulation of preheat ducts be carefully considered, since the value of the air recovered depends upon the maintenance of the highest temperature, and the maximum return from the investment requires that the most valuable portion of the heat content be conserved. It is the maximum temperature which needs conservation.

Petrol and Electric Sparks

Reporting to the Cape Town Corporation in regard to petrol sparks, the chief officer of the fire brigade says a point which must be borne in mind is the great danger from static or frictional electricity. In spite of precautions taken, many remarkable cases of ignition have occurred due to the way in which spirit in motion can generate static electricity, and this gives off a spark which ignites the petrol. As an instance, the ordinary petrol-tank wagons which are seen about the town can get charged with electricity due to the spirit in motion within the tank setting up static or frictional electricity. The tank wagon must be in electrical contact throughout, or a spark may jump from one part to another. Also a small length of chain must be suspended from the bottom of the tank wagon so that it will drag on the ground to enable this static charge of electricity to weep away, otherwise when the filling pipe from the wagon is placed in the underground tank a spark jumps across and off it goes. Again, the same thing happens if petrol is passed through a rubber pipe or through a chamois leather.

Material for Turbine Blades

In an effort to determine which of a number of materials will give the best service in terms of first cost, life and repairs there has been installed on the spindle of No. 2-A turbine at Colfax power station of the Duquesne Light Company, in the region of most severe service, a group of 24 different kinds of blade materials, including a great variety of metals arranged in different alloys, with various treatments, and with different finishes, according to the *Electrical World*. In such a research the use of certain materials is to be expected, but others among those listed may occasion surprise. Their presence illustrates the scope such an investigation may assume when a thorough-going effort is made to get the most desirable combination of qualities, for instance: Gold, silver, nickel, zinc, platinum, carbon, cobalt, chrome, monel, tungsten, stellite, contracid, ludlum, nitralloy, palladium, rezistal, tantalum. The blades are arranged in small groups of about eight each, similar groups being placed diametrically opposite each other. Each group is numbered, the identification being stamped on each blade in two places. Arrangement of the groups is designated with reference to certain fixed points on the turbine spindle, similarly marked and numbered. The record system has been worked out to insure positive identification of each blade later. The installation is made by the best craftsmen available, in order that the factor of workmanship shall be as favourable as possible. The service of these groups will be observed carefully and it is hoped that eventually a material will be found which can be secured at a reasonable price and will have such superior qualities that its service life will be greatly extended over that possible with materials now commercially available.

Domestic Electricity Consumption in the U.S.A.

The use of electricity in the United States for lighting and power purposes is increasing at the rate of nearly 1,200,000,000 kWh a year, according to a statement issued by the Statistical Research Department of the National Electric Light Association. This figure is based on a summary of total sales to ultimate consumers for the first six months of 1931, which show an increase in residential use of 7.2 per cent. over the corresponding period in 1930, and 22.7 per cent. over the first six months of 1929. A number of causes have contributed to this steady increase. During the first six months of 1931 new residential consumers connected brought the total number of such consumers up to 20,350,000, or more than 70 per cent. of all urban, suburban and rural homes in the country. During the same period the average annual consumption per domestic consumer increased from 548 to 563 kWh. At the same time, the average revenue per kWh sold for domestic purposes decreased 1.3 per cent., caused partly by reductions in rates and partly by the increased use of electrically-operated household appliances. Another factor is the rapid progress which the industry is making in the extension of rural electrification, the farmers last year using nearly 2,000,000,000 kWh of electric power. New rural uses for electricity are in heating hotbeds and in dehydrating fruits. At present more than 644,500 farms in the United States out of a total of 6,288,643 are making use of electric power. Consumption of electricity by small commercial concerns, stores, theatres, institutions, and similar places also shows an increase for the first half of this year, being 1.2 per cent. above that for 1930 and 9.2 per cent. above the banner year of 1929. On the other hand, large industrial and mining enterprises consumed 10 per cent. less power in the six months ended June 30th than they did in the corresponding period of 1930. For all purposes consumption of electricity for the first half of this year was 4.3 per cent. below the figure for the same period of 1930, but only 1.4 per cent. less than in 1929, when industrial activity was at an exceptionally high level. The total revenues of the industry for the six months were 0.8 per cent. below the figures for 1930, but still 4.3 per cent. above the total for the corresponding period of 1929.

International Hydro-electric; New Generator

Work is progressing rapidly on the installation of the seventh 34,000-h.p. generator in the Paugan, Quebec, hydro-electric plant of Gatineau Power Company, a subsidiary of International Hydro-Electric System. The speed ring, head cover, and scroll case have been completed, and the waterwheel shaft has been received at the station. No extension of the powerhouse structure has been required for the new unit, and only the cost of the machinery is involved, resulting in a comparatively low additional capital cost per h.p. Located in the Gatineau River, 35 miles north of the City of Ottawa, the Paugan station is one of the largest hydro-electric generating plants in North America, and with the new unit it will have an installed capacity of 238,000 h.p.

The new generator at Paugan will raise to 1,148,000 h.p. the installed capacity of the hydro-electric plants of International Hydro-Electric System. Of this, 679,000 h.p. is in the stations of Gatineau Power Company, and 469,000 h.p. is installed in the plants of New England Power Association.

Smoke Abatement Conference

The third annual conference of the National Smoke Abatement Society is to be held at Liverpool on September 18th, 19th and 20th. On the morning of the second day, after the annual general meeting, two papers will be presented, including "The Progress of the Electrical Grid," by Mr. Robert Blackmore, M.I.E.E., Central Electricity Board. In the afternoon there will be a motor tour, with visits to the housing estates, the new Clarence Dock power station, and other places of interest. In the evening there will be an informal meeting in the Adelphi Hotel. The proceedings will open the next day with the presentation of several short papers, and communications concerning the development and activities of the several joint committees by members of the committees will be read, followed by a discussion upon the various problems with which these committees are concerned. The presentation of these papers will be followed by a demonstration of the apparatus used for the measurement of atmospheric impurities (kindly loaned by the Department of Scientific and Industrial Research), by Mr. W. H. Roberts, M.Sc., city analyst, Liverpool. A council meeting will be held in the afternoon.

Appointment Vacant

Showroom assistant for Barrow-in-Furness Electricity Department (£202). (See our advertisement pages to-day.)

Ganges Hydro-electric Scheme

The Ganges hydro-electric scheme is, *Indian Engineering* states, an attempt to bring cheap electric power generated at the falls of the Upper Ganges Canal to 60 towns and large villages within an area of 10,000 sq. miles of agricultural country. The largest towns are Saharanpur (62,000), Meerut (78,000), and Aligarh (67,000); 27 others have populations exceeding 20,000, and there are 15 other towns with populations between 20,000 and 30,000, and 30 with populations between 5,000 and 10,000.

Domestic loads are growing rapidly in all the larger towns, chiefly for lighting and fans, but many of the larger municipalities are using electricity for street lighting, but it has been found that private lighting usually develops after public lighting has been introduced. Maximum retail kWh rates fixed in the distributing companies licences at 5½ annas for lights and fans, 1½ annas for minor industries, and one anna for agricultural purposes.

The chief rural requirement for motive power is for irrigation pumping. At the beginning of operations there were three power stations at three separate falls, but it was decided to link them up into one grid system with a view to securing greater reliability.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

The National Government

On Monday last the Labour Government resigned, and it was announced that Mr. Ramsay MacDonald had been asked by the King to form a National Government, consisting of leading members of the three political parties, to carry through measures to meet the financial emergency which has arisen. On Tuesday the names of the new Ministry were made public; the following is the list as it was at the time of going to press:—

Prime Minister and First Lord of the Treasury: Mr. J. Ramsay MacDonald.
Chancellor of the Exchequer: Mr. Philip Snowdon.
Lord President of the Council: Mr. Stanley Baldwin.
Lord Chancellor: Lord Sankey.
Minister of Health: Mr. Neville Chamberlain.
President of the Board of Trade: Sir Philip Cunliffe-Lister.
Home Secretary: Sir Herbert Samuel.
Dominions and Colonial Secretary: Mr. J. H. Thomas.
Foreign Secretary: Lord Reading.
Secretary for India: Sir Samuel Hoare.

The above will constitute the Cabinet. Other appointments are as follows:—

Minister of Labour: Sir Henry Betterton.
First Commissioner of Works: Lord Londonderry.
First Lord of the Admiralty: Sir Austen Chamberlain.
Secretary for Scotland: Sir Archibald Sinclair.
Minister of Agriculture: Sir John Gilmour.
Secretary for Air: Lord Amulree.
President of the Board of Education: Sir Donald Maclean.
Chancellor of the Duchy of Lancaster: Lord Lothian.

Mr. Sam Mavor, the head of Mavor & Coulson, Ltd., is to be presented with his portrait at the company's jubilee celebrations on September 4th. A presentation is also to be made to **Mr. W. A. Coulson.**

Sir Max Muspratt has been appointed trustee for the debenture stockholders of British Insulated Cables, Ltd.

Sir John Reith, managing director of the B.B.C., was one of the chief speakers at the opening session of the World Association for Adult Education in Vienna last week. All the speeches were relayed by the National Broadcasting Company of America to a chain of American stations.—*Reuter.*

Mr. J. H. Campbell, of the Belfast Corporation Electricity Department, has been appointed showroom assistant by the Leicester Electricity Committee. Over 200 applications were received for the position.

Mr. R. Murray, Director of Telephones, Cairo, has received official permission to wear the insignia of the Order of the Nile (third class) conferred upon him by the King of Egypt.

Mr. H. G. Massingham, an electrical pioneer and original owner of the Bath and Taunton Electricity Supply, is to give a public lecture on Michael Faraday at Brighton on September 13th, repeating it on the following day.

Mr. H. W. Rogers, who was recently married to Miss G. E. Pearce, was presented by his colleagues on the staff of the Salisbury Electric Light and Supply Co., Ltd., with a mahogany clock.

Mr. E. Morris, assistant engineer to the Carmarthen Electric Light Co., has been appointed resident engineer at Tenby by the West Cambrian Power Co. He will take up his new duties at the end of September.

The salary of the Belfast city electrical engineer (**Mr. F. H. Whysall**), which is based on the sales of energy, has been fixed at £1,976 for the year ending March 31st next. The Electricity Committee has decided that the salary of the deputy electrical engineer (**Mr. J. R. Struthers**) shall be maintained at £983 for the year.

Mr. R. H. Collett, who has been manager of the Pretoria municipal tramways for the past four years, has retired.

Mr. E. Delaunay has been appointed chairman of the new Australian broadcasting company—Barrier Broadcast, Ltd.

Mr. F. W. Clements, the former chief engineer and general manager of the Melbourne Electric Supply Co., Ltd., was recently presented with a Kernot Memorial Medal by the Melbourne University "for his work in establishing and extending the metropolitan electricity supply."

Sir John Monash, chairman of the Victorian Electricity Commission, has also been awarded a Kernot Medal "for his work in connection with the exploitation of Victoria's brown coal deposits and the bringing to fruition of the State electricity schemes."

Mrs. P. J. Pringle has established trust funds in Ballarat and Bendigo as a memorial to her late husband, Mr. F. J. Pringle, general manager of the Electric Supply Co. of Victoria, Ltd. The funds are to be used for making grants to employés of the company in cases of ill-health or accident.

Mr. F. E. Powell has resigned from the board of Messrs. Pinchin, Johnson & Co., Ltd., upon accepting the chairmanship of the American Sugar Commission at The Hague.

Obituary

Dr. W. E. Downey.—A week or two ago we had to report the death in a mountaineering accident of Mr. R. C. Clinker, research engineer to the British Thomson-Houston Co., Ltd. Another similar accident occurred on August 19th in Switzerland involving the death of Dr. W. E. Downey, of the G.E.C. Research Laboratories, Wembley, and two companions, Messrs. R. Kershaw and R. H. K. Peto. These three were members of a party belonging to the Imperial College Mountaineering Club and were descending the Jungfrau when one of the group slipped and dragged the others with him. The bodies were not found until two or three days later. Dr. Downey, who was 31 years of age, was educated at the Huddersfield Technical College and won a Royal Scholarship which took him to the Imperial College of Science and Technology. Here, he graduated as B.Sc.(London), and, remaining at the Imperial College, was later awarded the College diploma and received the Ph.D.(London) degree for some research work which he carried out. In 1924 he was awarded the Beit Fellowship for scientific research, and he remained at the Imperial College until 1926 when he joined the staff of the G.E.C. Research Laboratories. Later he became a member of the leading scientific staff of the laboratories and at the time of his death was responsible for the conduct of several branches of chemical research in the laboratories. Dr. Downey was a brilliant young man and had a personality which endeared him to all his colleagues.

Mr. Arthur Wright.—Mr. Charles L. Edgar, president of the Edison Electric Illuminating Company, of Boston, is quoted in the *Electrical World*, just to hand, as paying a tribute to the late Arthur Wright whose career was briefly reviewed in our July 31st issue. Mr. Edgar made his acquaintance thirty years ago. An arrangement was made with him to introduce his Wright meters into America and the Boston Edison Company used them in large quantities for a good many years. Under arrangement with Mr. Edgar, Mr. Wright used to visit Boston twice a year and spend two weeks giving the Edison people the latest news as to the developments in Europe and giving them the benefit of his advice as to the problems which were continually arising in the Edison Company. With the exception of one year during the war these twice-yearly visits continued, being timed so that he could attend the annual convention of the Association of Edison Illuminating Companies. Mr. Edgar says that he had always looked upon Arthur Wright as "the leading electrical engineer in Europe."

Mr. R. L. Horsfield.—We regret to learn of the death on August 25th of Mr. Robert L. Horsfield, who had been general manager of the Leeds Corporation tramways since 1928. He died after a very brief illness, and was only 57 years of age. Prior to going to Leeds, Mr. Horsfield was for over eight years general manager of the Cardiff Corporation tramways, and before that served for 17 years as general manager of the Walsall Corporation system. He went to Walsall from Bradford where he had been chief assistant in the Corporation Tramway Department. Mr. Horsfield had thus devoted his whole career to tramway work and was naturally well-known in that sphere. He was responsible for the introduction and operation of motor-omnibus services into industrial districts, and received the M.B.E. for special work during the war in the transport of munition workers to and from the factories. Mr. Horsfield was a member of the Institute of Transport, and was president of the Municipal Tramways and Transport Association in 1926-1927.

Mr. J. Adamson.—We regret to hear from the Institute of Marine Engineers of the death of Mr. James Adamson, who had been honorary secretary of the Institute since its foundation in 1889. Mr. Adamson was 81 years of age. The funeral took place at Pinner last Monday.

Dr. E. Ruhle.—The death occurred recently in Berlin, at the age of 68 years, of Dr. Ing. Ernst Ruhle, the chief engineer of the Berlin Electricity Supply Co., with which undertaking he had been associated for the past 27 years.

Mr. F. T. Smith.—Mr. Frederick T. Smith, who died at Danbury, Essex, last week, was a pioneer of electricity supply in Northern England. He retired about five years ago and left Yorkshire to reside with his son Mr. C. H. Smith, who is technical manager of the Hoffman Manufacturing Co.

Mr. J. W. E. Shore.—The death occurred last week of Mr. J. W. E. Shore, an electrical engineer employed by the English Electric Co., Ltd. At the time of his death he was engaged on a contract for the Bath Corporation.

Mr. B. Ford.—The *Electrical World* reports the death, on August 10th, of Mr. Bruce Ford, who was second vice-president of the Electric Storage Battery Co. (U.S.A.) and a director of the Chloride Electrical Storage Co., Ltd. He had been connected with the Electric Storage Battery Co. since 1899 and had over 50 storage battery patents to his credit.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered

W. Irving, Ltd.—Private company. Registered August 17th. Capital, £600 in £1 shares. Objects: To acquire the business of an electrical and mechanical engineer carried on by W. Irving, at 390, Sharrow Vale Road, Sheffield, and to carry on this and the business of motor and wireless engineers and manufacturers, &c. The first directors are: W. Irving, 123, Peveril Road, Sheffield, electrical engineer (permanent governing director); G. H. Kitching, 76, Hunter House Road, Sheffield, motor engineer. Registered office: 390, Sharrow Vale Road, Sheffield.

J. G. Mackey, Ltd.—Private company. Registered August 15th. Capital, £2,000 in £1 shares. Objects: To acquire the business of a wireless dealer carried on by J. G. Mackey, at 5, Amersham Hill, High Wycombe, Bucks. The directors are: A. Sacks, 284, Lillie Road, Fulham, and D. Sacks, 130, Kentish Town Road, N.W. Registered office: 184, Dawes Road, Fulham, S.W.6.

Cam Electrical, Ltd.—Private company. Registered August 15th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers, repairers and retailers of goods in connection with wireless telegraphy, telephony and television, &c. The subscribers are: A. Kinge, 58, Montana Road, S.W.17, and E. R. M. Calder, 29, Gertrude Street, S.W.10. The first directors are to be appointed by the subscribers. Registered office: 113, Euston Street, N.W.1.

P. R. Products, Ltd.—Private company. Registered August 15th. Capital, £500 in £1 shares. Objects: To acquire the business of an electrical and radio engineer and dealer, &c., carried on by W. E. Debrunner as "Peter Russell," at Newgate Street, E.C., or elsewhere. The first directors are: R. W. Debrunner, 340, Eden Park Road, Beckenham, and W. E. Debrunner, 70, Christchurch Road, Tulse Hill, S.E. Registered office: 14, Newgate Street, E.C.

Neoneleetric Co.—Private company. Registered August 17th. Capital, £900 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in glass tubing containing various gases to be used for electrical illumination, &c. The subscribers are: Mrs. M. W. Furneaux, 76, Norfolk House Road, Streatham, S.W.16, and Maud P. Prebble, 3, Garnet Road, Willesden, N.W.10. The first directors are to be appointed by the subscribers. Secretary: E. Weinbaum. Solicitors: Garton and Co., 21, Maddox Street, W.1.

Devereux (1931), Ltd.—Private company. Registered August 21st. Capital £500 in £1 shares. Objects: To carry on the business of dealers in and hirers of electrical machines, devices and apparatus including radio-telephony and telegraphy, &c. The directors are: R. Pearce, 3, Abergeldin Road, Eltham, S.E.; J. N. P. Bouch, 27a, Ebury Street, Victoria, S.W.1. Registered office: 3, Occupation Road, Manor Place, Walworth, S.E.17.

Returns of Electrical Companies

A. E. Morrison & Sons, Ltd.—First mortgage dated January 31st, 1921, and second mortgage dated March 17th, 1922, charged on Regalite Works, Gartree Street, Leicester (property acquired April 30th, 1929), on which £403 11s. 7d. and £1,000, respectively, was owing on November 1st, 1929. (Now registered pursuant to Section 91 of the Companies Act, 1929.) Mortgagees: Leicester Permanent Building Society, and Mrs. A. R. Goddard, "Syracuse," London Road, Leicester.

A. F. Yarnold, Ltd.—Capital, £2,000 in 500 preference and 1,500 ordinary shares of £1. Return dated December 31st, 1930 (filed May 1st, 1931). 350 preference and 685 ordinary shares taken up. £1,035 paid. Mortgages and charges, nil.

E. S. White & Co., Ltd.—B. Silcock, 31, Bold Street, Warrington, ceased to act as receiver and manager on July 28th, 1931.

Bulle Co., Ltd.—Debenture dated July 29th to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: A. Bingguely and Juliette Bingguely, both of 77, Rue du Nord, La Chaux de Fouds, Switzerland, and others.

Burke & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated July 15th, 1930 (filed April 24th, 1931). All shares taken up. £2 paid. £998 considered as paid. Mortgages and charges, nil.

C. C. A. (Vacuum Cleaners), Ltd.—Debenture, dated August 6th, 1931, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: P. Pfeiffer, W. Mauz, L. Hahn and E. Faber (trading as Mauz & Pfeiffer, at Stuttgart, Germany).

Chepstow Electric Lighting & Power Co., Ltd.—Capital, £10,000 in £1 shares. Return dated April 7th, 1931. 5,510 shares taken up. £1,605 paid. £3,905 considered as paid. Mortgages and charges: £1,000.

Ashley Wireless Telephone Co. (1925), Ltd.—Capital, £2,500 in £1 shares. Return dated December 31st, 1930 (filed April 24th, 1931). All shares taken up. £2,500 paid. Mortgages and charges, nil.

Electric Service Co. (Grimsby), Ltd.—Capital, £1,000 in £1 shares. Return dated April 13th, 1931. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Elstree Radio, Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1930 (filed May 5th, 1931). Four shares taken up. £4 paid. Mortgages and charges, nil.

George Ellis, Ltd.—Capital, £2,000 in £1 shares. Return dated May 14th, 1931. 1,152 shares taken up. £2 paid. £1,150 considered as paid. Mortgages and charges, nil.

Great Eastern Radio, Ltd.—Particulars filed of £5,000 debentures authorised August 6th, 1931, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

J. K. W. Manufacturing Co., Ltd.—Capital, £6,000 in £1 shares. Return dated April 10th, 1931. 3,100 shares taken up. £1,000 paid. £2,100 considered as paid. Mortgages and charges, nil.

Sewell & Varley, Ltd.—Capital, £1,500 in £1 shares. Return dated April 8th, 1931. 902 shares taken up. £152 paid. £750 considered as paid. Mortgages and charges, nil.

Shipton Automatic Telephone System, Ltd.—Capital, £100 in £1 shares. Return dated December 30th, 1930 (filed March 30th, 1931). Three shares taken up. £3 calls unpaid. Mortgages and charges, nil.

Television Supplies, Ltd.—Capital, £2,100 in 2,000 ordinary shares of £1 and 2,000 deferred ordinary shares of 1s. each. Return dated December 31st, 1930 (filed February 25th, 1931). Two ordinary shares taken up. £2 paid. Mortgages and charges, nil.

Tounlea Electrical Co., Ltd.—Capital, £1,000 in 300 preference and 700 ordinary shares of £1. Return dated January 14th (filed April 27th), 1931. 500 ordinary shares taken up. £500 considered as paid. Mortgages and charges, nil.

Tredegars, Ltd. (formerly Tredegars (1923), Ltd.).—Satisfaction to the extent of £1,000 on April 28th, 1931, of debentures authorised April 24th, 1925, and registered May 12th, 1925. Notice filed August 11th. (According to the register of mortgages, the debentures, registered May 12th, 1925, originally secured £12,000.)

William Geipel, Ltd.—Capital, £25,150 in 25,000 preference, 100 "A" ordinary and 50 "B" ordinary shares of £1. Return dated June 18th, 1931. All shares taken up. £23,650 paid on 23,500 preference, 100 "A" ordinary and 50 "B" ordinary shares. £1,500 considered as paid on 1,500 preference shares. Mortgages and charges, nil.

West Gloucestershire Power Co., Ltd.—Capital, £685,000 in £435,000 6½ per cent. participating preference stock and £235,000 ordinary stock and 15,000 ordinary shares of £1 each. Return dated April 7th, 1931. All the preference and ordinary stock taken up. £435,500 paid on the preference stock and £500 of the ordinary stock. £234,500 considered as paid on £234,500 of the ordinary stock. Mortgages and charges: £510,000.

City Notes

Imperial & International Communications, Ltd., reports that the estimated traffic receipts for July were £377,774, as compared with £437,220 in July, 1930, a decrease of £59,446. In addition £21,000 must be deducted from the message receipts, in making a comparison with July, 1930, owing to changed conditions of heavy traffic. For the seven months of the current year the aggregate receipts were £2,761,723, a decrease of £483,220 as compared with the corresponding period of 1930.

Pinchin, Johnson & Co., Ltd. have declared an interim dividend of 10 per cent. actual, less tax, on the ordinary shares (same).

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets have been mainly under the influence of the political developments which have resulted in the formation of a new and temporary Cabinet. The immediate effect was salutary. Prices of gilt-edged stocks moved up under the leadership of British Government funds. There was a rattling of the dry bones amongst industrials, on the impression that one of the new revenue propositions likely to be put forward will take the form of a tariff on manufactured articles. This served to bring about improvements in the prices of iron, steel, and similar shares. The atmosphere of depression, which had hung over markets as a whole, gave place to a more cheerful air. The hope that the finances of the country will be put upon a sound basis engendered a feeling of confidence. There has been, up to the present, little improvement in the volume of actual business, but the Stock Exchange is too well accustomed to quietude during August for members of the House to be more than mildly disappointed at the refusal of the public to take an active participation in the markets.

Home Electricity Shares

There are no changes to record in the list of home electricity supply shares. The market maintains its accustomed steadiness, and, as pointed out here last week, the shares in this group have the attraction of being likely to receive some additional rate of dividend over and above the 7 per cent. laid down by the Act. This might come by way of a possible distribution of reserves, rather than through an advance in the immediate future upon the 7 per cent. mentioned in the Act. Of the ordinary shares, 1,000 County of London can be bought at 46s. cum dividend, to pay £4 15s. 6d. per cent. on the money. Two thousand Metropolitan Electric ordinary are on offer at 41s., yielding £4 17s. 6d. at that price, and 2,000 Westminsters at 29s. 3d. xd. The last-named return a shade over 6 per cent. at the moment, but on the 7 per cent. standard the yield would be reduced to 4¾ per cent. There are on offer 500 Notting Hill Electric shilling deferred shares at 7¼ xd. An interim dividend of 10s. per share has been paid in respect of the current twelve months. For 1930, the dividend was 17s. 4d. per share, against 16s. 7d. in the previous year. The yield of 12 per cent. at the present price can be quoted only as a matter of interest, because it is practically certain to be reduced next year.

Provincial Electricity

The provincial shares are as quiet as those of the London group. Amongst the shares on offer may be mentioned 2,000 Lancashire Electric Light & Power ordinary at 21s. 6d., giving 6 per cent. on the money, 1,000 Llanelly & District ordinary at 15s., yielding £4 13s. 3d., 250 Mid-Cheshire ordinary at 25s. 3d., returning £5 18s. 9d. per cent., and 1,000 Northampton ordinary at £2 cum. dividend, which will pay 5 per cent. without taking into account the accrued dividend. There are also available 1,000 Yorkshire Electric Power ordinary at 30s. 9d. xd., which offer £5 4s. 1d. per cent. on the money. Under the new Stock Exchange Regulations, London Electric ordinary are now quoted ex dividend, the price at 33s. 6d. showing no alteration, allowing for the dividend taken off. Midland Counties preference, at 24s., are ex, and so are South Metropolitan 7½ per cent. preference at 27s. Newcastle-on-Tyne Electric 5 per cent. consolidated debenture stock is a point lower at 103.

Cables and Wireless

Improvements have taken place in the Cables & Wireless issues, partly in sympathy with the better tendency manifested throughout the Stock Exchange, partly on account of an interesting rumour emanating from New York to the effect that the British Post Office may take over the Imperial and International Communications system. Ever since the inception of the Cables & Wireless merger, the attitude of the Post Office towards it has been one of unveiled hostility. Stockholders have seen, with chagrin and exasperation, the Post Office working in co-operation with American companies, instead of doing all it could to encourage the British system. If this competition were to be eliminated, the outlook for Cables & Wireless would brighten appreciably. The mere anticipation of the rumour proving true had a strengthening effect upon the prices. Meanwhile, the traffic receipts of the combine continue poor, the figures for last month showing a decrease of £59,400, as compared with those of July, 1930. The aggregate decrease in 1931, from January to July inclusive, is now £483,000, and, as is only too well known, the dividend on the preference stock due to be paid next month will not be met at the proper date.

Telephones and Telegraphs

The price of American Telephone & Telegraph is 5 down at 175, International Telephones, at 29, are a point lower. Western Union Telegraph shares, at 115, show a fall of 5 points. On the other hand, Globe Telegraph & Trust ordinary have risen to 6; they were 5 a fortnight ago. The preference have gone back to 8. Anglo-American Telegraph ordinary, which rarely moves, has advanced to 59½. International Automatic Telephones, at 28s 9d., show a slight decline. Marconi Marines are easier at 30s. on fears lest the 15 per cent. dividend may have to be cut.

Foreign Tramways Erratic

In the market for foreign issues the weakness of Mexicans is further accentuated; Mexican Light & Power 7 per cent. preferred shares have shed 5 more points, reducing the price to 52½. At this, the yield on the money comes to £13 6s. 8d., a return that hints clearly enough at the fears relating to the dividend. Shares have changed hands lately as low as 50. The 4 per cent. second preference shares, of 5 dollars nominal, stand at 35s. The first mortgage bonds are 2 down at 62½, and the seconds have fallen to 60. Of the tramway shares, Mexico Tramways common last changed hands on the basis of 8, while the company's 6 per cent. 50-year mortgage bonds are quoted nominally at 5 to 12. The 5 per cent. first mortgage bonds can be bought at about 31½. Brazilian issues are well maintained, and the bonds of the Rio Tramway Company stand out amongst the few which have shown resistance to the recent flatness of investment stocks. The price of the first mortgage bonds is 97½, the 5 per cent. 50-year mortgage bonds being quoted at 86½. San Paulo Tramway Light & Power 5 per cent. debenture stock is quoted at 80 middle. Brazilian Tractions, at 18½, show a rise of the fraction, and the preference shares remain unchanged at 90. Those who are curious in such matters will observe with interest that the last two bargains marked in the shares, and consecutively, are at 80 and 90.

Anglo-Argentine Tramways show no recovery, the three classes of debenture stocks standing at 48½, 40½, and 18 for the 4, 4½, and 5 per cent. stocks, respectively. Transactions have been recorded during the past few days in the last-named stock at 15, 16, and 17.

Manufacturing and Equipment

The better tendency amongst industrials as a whole has not yet found its way to the market for electrical manufacturing and equipment shares. British Insulated are lower at 2 11/16. Telegraph Constructions, at 9½, are 10s. down. Callender's remain dull at 2½, and Henley's are lower at 4¾. Enfield Cables, at 3¾, are ex dividend. British Aluminium have gone back to 25s. Callender's Investment Trust 5 per cent. debenture stock, at 101½, is ex dividend. G.E.C. ordinary have recovered to 40s. 9d., a rise of 9d., and Ferranti preference have added the turn at 20s. 6d. Babcock & Wilcox, at 43s. 9d., are 9d. higher on the week. Vickers advanced to 7s. 6d., but failed to hold the full extent of the rise. The rubber market is somnolent, under the harrow of the present price, about 2 5/16d. per lb. of the produce.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES

	Nom.	Approx. Dividend 1929.	1930.	Price Aug. 25 1931.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	58/9xd	—	5 2 0
Brompton Ordinary	1	8¾	8½	28/6	—	4 18 3
Central Electricity 4½% Deb. ...	Stock	—	4½	96⅞	—	4 13 0
Charing Cross Ordinary	1	8½	8½	30/6xd	—	4 11 10
Chelsea	1	8¾	8¾	28/-	—	5 0 0
City of London	1	10	10	37/-	—	5 8 1
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	11	11	45/-	—	4 17 9
Edmundsons' 7% Pref.	1	7	7	26/-	—	5 7 8
Elec. Supply Corporation	1	11	11	45/-	—	4 17 9
Kensington Ordinary	1	8	8	29/6	—	4 15 0
Lancs. Light and Power	1	7	6½	21/3	—	6 2 4
London & Home Counties 4½% Deb.	Stock	—	—	96½	—	4 13 3
London Electric	1	8½	9	33/6xd	—	5 7 6
Metropolitan	1	9	10	2⅛	—	4 18 9
Midland Counties	1	6½	7	27/6	—	5 1 10
Mid. Elec. Power	1	15	8	28/3	—	5 13 3
Newcastle-on-Tyne Ordinary ...	1	6	6	22/-	—	5 9 1
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6	6	11¼	—	5 6 8
North Met. Elec. 6% Pref.... ...	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall	1	8	8	29/6	—	4 15 0
Scottish Power	1	8	8	27/6	—	5 16 3
South London	1	8½	8½	27/6	—	5 1 10
Urban Ordinary	1	7	7	28/3	—	4 19 1
Westminster Ordinary	1	8¼	8¼	29/6	—	4 15 0
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	25/3	—	5 18 10
Yorkshire Elec.	1	8	8	30/9	—	5 4 1

HOME RAILS

Central London Ord. Assented ...	Stock	4	4	77	—	5 3 6
Metropolitan	,,	4	3½	87	+½	9 6 9
do. District	,,	5		60½	—	8 5 4
Underground Electric	£1	8	8	19/6	—	8 4 2

TELEGRAPHS AND TELEPHONES

Anglo-Am. Tel. Pref....	Stock	6	6	103	—	5 17 8
do. Def-	,,	1½	1½	25	—	6 0 0
Cables & Wireless 5½% Pref. ...	Stock	5½	5½	49½	+2	... ...
do. A 7½% Ord.	,,	Nil	—	15	+2	... ...
do. B Ord.	,,	Nil	—	8	+1½	... ...
Globe Tel. and T. Ord.	10	10	8½	6	+⅛	...
do. do. Pref.	10	6	6	8	—½	7 10 0
Great Northern Tel....	10	20	20	25	—	8 0 0
Marconi-Marine	1	15	15	30/-	—2d.	10 0 0
Oriental Telephone Ord.	1	12	12	2⅞	—	*5 9 6

HOME AND FOREIGN TRAMS, &C

Anglo-Arg. Trams First Pref. ...	5	5½	—	10/-	—	... ...
do. do. 2nd Pref. ...	5	6	—	7/6	—	... ...
do. do. 5% Deb. ...	Stock	5	5	18	—	.. ...
British Electric Traction Def. Ord.	,,	5	5	77⅝	—	... ...
do. do. Pref. Ord. ...	,,	8	8	124½	—	6 8 9
Brazil Traction	100	8	—	18¼	+¼	... ...
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	96½	—	5 3 3
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	63¼	—	6 7 0
Mexico Trams, 5% Bonds	—	5	5	31½	—	15 17 6
Mexican Light Common	100	Nil	Nil	25	—	... ...
do. 7% Pref.	100	7	7	52½	—5	13 6 8
do. 1st Bonds	—	5	5	62½	—2	8 0 0
Victoria Falls Ord.	1	15	15	57/6	—	5 4 4
Yorkshire (West Riding)	1	Nil	Nil	6/3	—	... ...

MANUFACTURING COMPANIES

Assoc. Elec. Ord.	1	6	6	20/-	—	6 0 0
do. Pref.	1	8	8	28/3	—	5 12 3
Babcock & Wilcox	1	15	14	43/9	+9d.	*6 8 0
British Aluminium Ord.	1	10	10	25/-	—9d.	8 0 0
British Insulated Ord.	1	15	15	2 11/16	—1/16	5 11 6
Brush Ord.	Stock	10	5	60	—	8 5 0
Callenders	1	15	15	2½	—	6 0 0
do. 6½% Pref....	1	6½	6½	26/3	—	4 19 1
Crompton Parkinson Ord.	5/-	30	30	1	—	7 10 0
do. 8% Pref.	1	8	8	28/3	—	5 13 8
Edison-Swan 1st Pref.	1	7½	7½	23/3	—	6 9 0
do. 5% Deb	Stock	5	5	92½	—	5 8 1
Electric Construction ...	1	5	Nil	10/-	—	... ...
Enfield Cable Ord.	1	25	25	3¾xd	—	6 8 10
English Electric	1	Nil	Nil	5/-	—	... ...
do. do. Pref.	1	Nil	Nil	5/-	—	... ...
Ferranti Pref.	1	7	7	20/6	+3d.	6 18 3
G.E.C. Pref.	1	6½	6½	25/6	—	5 2 0
do. Ord.	1	14	10	40/9	+9d.	4 18 8
Henley	1	30	30	4¾	—⅛	6 3 0
do. 4½% Pref.	5	4½	4½	4¾	—	5 2 10
India-Rubber	1	Nil	Nil	4/6	—	... ...
Johnson & Phillips	1	10	10	28/9	—	6 19 2
Siemens Ord.	1	7½	7½	29/9	—	7 4 7
Telegraph Construction	12	10	7½	9¼	—½	9 9 8

*Dividends paid free of Income Tax.

Swedish Electrical Exports

The statistics for 1929 and 1930 compared

THE following tables, based on the recently-issued Swedish trade returns, compare last year's electrical exports with those for the preceding year, showing the increases or decreases. Details of the principal destinations are also given. The increasing trade with Soviet Russia is an outstanding feature of the statistics.

	1929. 1,000 Kron.	1930. 1,000 Kron.	Inc. or dec. 1,000 Kron.
Cells and batteries—			
Total	2,759	3,512	+ 753
To Great Britain	21	54	+ 33
,, Norway	323	314	− 9
,, Austria	90	72	− 18
,, Soviet Russia	881	1,440	+ 559
,, Japan	71	20	− 51
Wireless apparatus—			
Total	3,131	4,210	+ 1,079
To Norway	140	315	+ 175
,, Denmark	639	356	− 283
,, Finland	304	279	− 25
,, France	38	13	− 25
,, Spain	29	117	+ 88
Generators and motors weighing not more than 50 kg. each—			
Total	4,700	910	− 3,790
To Denmark	26	39	+ 13
,, Netherlands	69	12	− 57
,, Great Britain	144	460	+ 316
,, United States	58	2	− 56
,, Australia	94	9	− 85
,, Brazil	1,180	5	− 1,175
,, Argentina	795	48	− 747
Ditto, 50-3,000 kg.—			
Total	7,184	7,480	+ 296
To Soviet Russia	990	600	− 390
,, Norway	521	400	− 121
,, Finland	915	580	− 335
,, Great Britain	775	708	− 67
,, Spain	489	535	+ 46
,, Argentina	110	235	+ 125
,, New Zealand	69	60	− 9
,, Australia	186	53	− 133
,, Belgium	726	1,380	+ 654
More than 3,000 kg.—			
Total	4,094	4,243	+ 149
To Finland	319	607	+ 288
,, Belgium	309	383	+ 74
,, Canada	665	1,050	+ 385
,, Italy	216	250	+ 34
,, Soviet Russia	377	202	− 175
Transformers, not more than 50 kg. each—			
Total	140	120	− 20
To Denmark	6	14	+ 8
,, France	9	20	+ 11
,, Italy	2	10	+ 8
Transformers, 50-3,000 kg.—			
Total	1,810	1,520	− 290
To Belgium	160	176	+ 16
,, France	156	145	− 11
,, Spain	155	160	+ 5
,, Brazil	195	160	− 35
Transformers weighing more than 3,000 kg.—			
Total	1,700	2,790	+ 1,090
To Soviet Russia	160	11	− 149
,, Belgium	610	1,407	+ 797
,, Italy	31	171	+ 140
,, Great Britain	69	40	− 29
Vacuum cleaners—			
Total	9,834	10,620	+ 786
Electricity meters—			
Total	20	14	− 6
To Soviet Russia	10	—	− 10
Other electrical measuring instruments—			
Total	67	51	− 16
Electric lamps (metal filament)—			
Total	216	129	− 87
To Finland	57	9	− 48
,, Denmark	66	48	− 18
Carbon for electrical purposes—			
Total	345	365	+ 20
To Norway	107	40	− 67
,, Finland	28	44	+ 16
,, Italy	12	7	− 5
Starting, regulating and reduction resistances—			
Total	1,477	794	− 683
To Soviet Russia	247	22	− 225
,, Spain	108	118	+ 10
,, Australia	17	4	− 13
,, Finland	192	104	− 88
Stators, rotors, current collectors, magnet coils, &c.—			
Total	1,088	4,560	+ 3,472
To Norway	202	97	− 105
,, Finland	44	92	+ 48
,, Great Britain	84	450	+ 366
,, Soviet Russia	60	225	+ 165
Oil-break switches—			
Total	690	450	− 240
To Soviet Russia	245	50	− 195
,, Spain	35	38	+ 3
,, Great Britain	2	39	+ 37
,, Finland	75	36	− 39
Other switches—			
Total	332	280	− 52
To Finland	42	40	− 2
,, Soviet Russia	61	7	− 54
,, New Zealand	2	26	+ 24
Safety appliances, mounted or not—			
Total	550	682	+ 132
To Finland	89	72	− 17
,, Poland	51	53	+ 2
,, Netherlands	84	47	− 37
,, British South Africa	42	26	− 16
Telephone and telegraph apparatus—			
Total	—	15,510	—
To Poland	—	3,170	—
,, Netherlands	—	2,330	—
,, Italy	—	1,940	—
,, Mexico	—	2,490	—
Cable and wire (metal sheathed)—			
Total	3,231	4,010	+ 779
To Poland	385	116	− 269
,, Finland	533	280	− 253
,, Mexico	619	1,580	+ 961
,, Argentina	636	1,000	+ 364
Cable and wire insulated with textile materials, paper, varnish, &c.:—			
Diameter of wire not more than 0.5 mm.—			
Total	478	970	+ 492
To Great Britain	12	20	+ 8
,, Denmark	38	68	+ 30
,, Poland	82	240	+ 158
,, British South Africa	50	80	+ 30
Do., greater than 0.5 mm.—			
Total	406	326	− 80
To Mexico	—	40	+ 40
,, Netherlands	28	26	− 2
,, Finland	54	32	− 22
,, Soviet Russia	180	6	− 174

Prospective South African Schemes

According to the monthly trade cables and reports from branches for August from Barclay's Bank (Dominion, Colonial, and Overseas), the Benoni Council has applied for sanction of a loan to extend the town's power station. The proposed scheme is estimated to cost £37,000. The existing power station at Senekal, Orange Free State, is proving inadequate for the growing needs of the town, and the Council has decided to install a new undertaking at approximately £8,000. It is believed that Graaff Reinet, Cape Province, is contemplating raising a loan of £30,000 for the purpose of converting the present d.c. system to a.c. and for the erection of a new power station equipped with two 250-kW generators. Owing to the increasing demands at Uitenhage, Cape Province, it is expected that the plant will require to be considerably enlarged by next winter.

Water-power in Switzerland

Total resources of 4,000,000 h.p. of which 2,690,000 h.p. awaits development

THE Department of Overseas Trade has received a memorandum from the Commercial Secretary to H.M. Legation at Berne, Switzerland, from which it appears that only two power stations were put into service last year, namely, that of Champsec* (Valais) with installed plant rated at 12,000 h.p., and that of Ryburg-Schworstadt (Aagau) of a maximum rating of 150,000 h.p., of which 70,000 h.p. was in operation at the end of 1930. The output of this station is shared equally by Switzerland and the Free State of Baden (Germany).

The Handeck power station of the Oberhasli Power Company (Canton Berne) has been equipped with a second generating group of 30,000 h.p., following upon the installation of the first group of a similar rating in 1929. At the end of 1930 work was proceeding on the undermentioned power schemes:—

Schwanden (Glarus)	38,000 h.p.
Dixence (Valais)	175,000 h.p.
Monte Piottino (Ticino)	85,000 h.p.
Orsieres (Valais)	30,000 h.p.
Albruck-Dogern (Aargau)	96,000 h.p.
Wettingen (Aargau and Zurich) ...	28,000 h.p.

In the case of the Albruck-Dogern works on the Rhine, Switzerland will eventually be entitled to 54 per cent. of the total output and the Free State of Baden to 46 per cent.

On January 1st, 1931, the total rating of hydro-electric plant in operation in Switzerland was placed at 2,310,000 h.p., in addition to which 420,000 h.p. was under construction. Calculated on the basis of a constant output during 15 hours per day, the total water resources of the country amount to about 4 million h.p., of which 2,690,000 h.p. still remains to be utilised. Last year the Federal Water Board approved of 15 projects for the harnessing of water power in various parts of the country.

The climatic conditions were more favourable to the production of water power during the hydrological year which extended from October 1st, 1929, to September 30th, 1930, than during the previous 12 months and the prospects for the year 1930-31 were distinctly better in the autumn than had been the case at any time since 1928. During the period under consideration the storage capacity of artificial lakes was increased from 357 to 422 million kilowatt-hours, whilst the aggregate maximum output of the plant installed rose from 935,000 to 985,000 kilowatts. The possibilities of production in recent years have been as follows:—

1926-27	4,201	million	kWh.
1927-28	4,155	,,	,,
1928-29	4,304	,,	,,
1929-30	4,426	,,	,,

The corresponding figures of the extent to which the power plant was actually utilised are given as 73¼, 81, 82½, and 79½ per cent., respectively. The actual output of power undertakings is summarised in the following table:—

	1927-8	1928-9	1929-30
	(in million kWh)		
Output: power companies ...	3373.0	3556.3	3511.2
industrial undertakings	200.0	184.4	128.6
thermic stations, and imports	16.0	26.1	41.7
Total	3589.0	3766.8	3681.5
Exports	1090.6	1117.3	959.2
Power consumption in Switzerland	2498.4	2649.5	2722.3

The Nature of the Demand

The decrease of 85 million kWh in production during the year 1929-30 (as compared with 1928-29) exclusively affected exports, which had to be restricted in consequence of the prevailing drought during the winter months of 1929-30. The deficiency could not be made up during the following months when, as stated above, the conditions for power production were more favourable. The distribution of the power consumed in Switzerland is shown below:—

	1928-9	1929-30	Difference in:	
	(in million kWh)		Mill. kWh	%
Light, power and heating ...	1,883	1,957	+ 74	+ 3.9
Traction	214	225	+ 11	+ 5.1
Electro-chemical and metallurgical processes ...	468	463	− 5	− 1.1
Pumping stations for storage lakes	85	78	− 7	− 8.2
Exports	1,117	959	−158	−14.2
Totals	3,767	3,682	− 85	− 2.3

Exclusive of exports, there was an increase in consumption amounting to 80 million kWh, or 3.1 per cent. It should be noted that the foregoing figures of production and consumption relate exclusively to power supplied by producers to outside consumers and do not include the output of plant belonging to railway or industrial undertakings absorbing their own production, except in so far as these undertakings supply their surplus output to outside consumers. At the end of 1930 export licences had been issued for a total of 475,611 kW, of which 302,271 kW was actually available, the remainder concerning the output of plant which has not yet been erected.

* See ELEC. REV., July 10th, 1931, p. 70.

German Industry

Co-operation and cheaper production

OWING to its great development during the past ten years the electrical manufacturing industry in Germany has become the most important consumer of non-ferrous semi-products. The large concerns, such as the A.E.G., the Siemens undertaking, and Felten and Guilleaume, of course, possess their own rolling mill plants which with their recent large extensions to-day rank amongst the largest and best-equipped in the country. Yet so constant has been the growth of their electrical requirements that their own rolling-mill plants are inadequate to meet their needs, and additional purchases have to be made.

The *Rheinische-Westfalische Zeitung* points out that the regulations of the semi-finished syndicates for non-ferrous metals permit of such firms as the above being members through their rolling mills, and obtaining deliveries at prices which are not controlled by the syndicates, so that they are able to get materials at specially favourable prices when tonnage is needed in excess of their own particular production. Apparently this facility has given an incentive to the electrical firms to buy extra quantities instead of further extending their own mill plant and success has resulted.

Agreements Between Metal and Electrical Companies

At the end of 1928 an agreement was entered into between the A.E.G. and the second largest rolling mill undertaking—the Hirsch Copper and Brass Works Company—under which the former undertook to purchase a definite quantity of semi-products from the latter. The raw material is delivered by the A.E.G. so that it only remains for the Hirsch Company to work it up into semi-products. The former has the advantage of low costs of conversion, and the latter of reduction in general costs of production.

A step in the same direction is now reported to have been taken by the Siemens concern. In this connection it is mentioned that the Siemens-Schuckert Company and the Metall Gesellschaft recently established the Siemens-Lurgi-Cottrell Electric Filter Company for the management of their joint patent rights in the electric filter installations branch. It is not thought that the joint interests of the two companies will be limited to this transaction but that co-operation of a general nature is in view, for Herr Carl von Siemens has been elected a director of the Metall Gesellschaft, and Dr. A. Merton a director of the Siemens-Schuckert Company. Probably the formation of the Electric Filter Company is only one result of this co-operation.

The Linking-up of Interests

The Metall Gesellschaft through its own German works, its ore and metal trade, and its connection of interests with the English Amalgamated Metal Company, is not only the most important German supplier of non-ferrous metals, but through its control of the Ver. Metallwerke, A.G., it is also the largest German producer of non-ferrous metals.

Under the circumstances the newspaper referred to records the following developments: The German Metall Gesellschaft enters into a connection with the Amalgamated Metal Company for ensuring its supply of raw materials. Shortly afterwards the Metall Gesellschaft's rolling mill in Heddernheim and the works of the Berg-Heckmann-Selve Company were converted into the Ver. Metallwerke, in which the Metall Gesellschaft holds the majority of the shares, and consequently has an important customer for its raw metals. The last step is now found in co-operation with the Siemens concern so as to ensure the sale of its semi-finished products. Thus in the case of the two leading electrical firms there exists co-operation with the preliminary industry—the rolling mills—which in their turn are closely associated with the crude metal industry.

Irish Free State Electrical Imports

A very quiet tone continues to exist in the electrical trade in the Irish Free State, the imports of machinery and cognate apparatus during June last having amounted to a value of £44,944, bringing up the total for the first six months of the year to £323,452, a decrease of £135,689 as compared with the corresponding period of 1930. Details of the six months' imports are appended:—

	January—June 1930	1931
	£	£
Electrical machinery	156,046	94,652
Electric wires and cables	96,650	48,201
Electric lamps and parts	45,803	30,494
Wireless sets and parts	43,615	46,981
Other electrical goods	97,280	89,980
Copper wire	19,747	13,144
Totals	£459,141	£323,452

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Electrifying the Farm

With reference to Mr. Harrison Storer's article, "Electrifying the Farm," in your issue of August 7th, the author, I think, gives me more credit for electro-tillage development than I deserve and also underestimates the assistance received not from the electrical industry "as a whole" but from individual companies in the industry. It was Mr. Storer's intention, I know, to deal in a future and more detailed article with the good people who were courageous enough to back me substantially with equipment and advice, but misunderstandings are apt to arise and in fact have arisen, and perhaps it is better that I should now make public the assistance I have received, without which no experimental work could have been carried out by me. The General Electric Co., Ltd., I think, takes first place in my list. Shortly after the war I started on my first tractor—a long shot in the dark surely—and found this company willing to provide motors and control gear; the tractor would pull but would not manoeuvre easily and was a rank failure.

British Insulated Cables provided the feeding cable and Messrs Siemens the slip-ring and drum gear. I take off my hat to these early helpers for there was no talk then of the "grid" or even of rural electrification, and I was but an unknown and ignorant backwoodsman with everything to learn.

This failure cooled my ardour for some years, then the rural developments I had anticipated arrived, and again I screwed up my courage, designed a new tractor, and submitted drawings to the G.E.C.'s Edinburgh office. As a result I was invited to discuss details with Dr. Railing at Witton, and he decided to have new motors and gear designed for this effort, and thus permitted the construction of tractor No. 2. Messrs. Helmsly took their turn at providing a heavier cable and, as this was to be a serious effort, the Lothians Power Co. was successfully approached with a view to obtaining a supply on the farm, for in tractor development time to play about and power at your door are the two essentials.

It will be seen, then, that I have not been without assistance from the leading companies, and I desire publicly to acknowledge and thank these people for their help.

As to the future, there is still endless work to do and I think an effort should be made by the electrical and agricultural industries to get out of their water-tight tanks and work together. Ten years ago this was impossible, and to hint at electro-tillage to a farming or agricultural society was rank and utter folly—not even to be discussed.

But new men have arisen in our councils; they see what is going on around them and they are asking themselves whether the farming class is to be the only one condemned to drive the paraffin engine for all time. The view is universally held that electro-tillage is merely a question of time and the sooner the better.

I would remind your readers that the national agricultural societies are not poor, and I believe that if the leaders of the two industries could be brought together with a view to solving their problems, great benefits would accrue to each.

Practically speaking, power has arrived on the land and all the propaganda chatter about driving threshing mills and chaff-cutters and milking machines electrically has done its work. The electric drive is recognised as the best of all drives, but the scope for saving in the steading is limited, and we must dig deeper to justify rural electrification.

We should grasp the fact that the grass land in this country is going to be tilled, not because we want more food in this world but because we must "mop up" the unemployed and make them produce something this country has a market for and this is home-grown food. This, the country's biggest job, can be done electrically and if my appreciation of the situation is correct, and courage and capital are the solvents required, we shall surmount our difficulties, marry our oldest to our newest industry, and breed a class of landsmen who will keep our country where she should be, and without whom this country's days are numbered.

Drem, East Lothian,
August 18th, 1931. M. McDOWALL.

Repulsion-start Induction Motors

Mr. Philpott's article on "Miniature Electric Motors" is a welcome contribution to a much neglected subject. So neglected is this subject that erroneous ideas are very prevalent. In a letter in your issue of August 7th Mr. H. G. Poxon appears to be under the mistaken impression that the primary advantage of the repulsion-start induction motor is in its high starting torque. Even Mr. Philpott, who gives on the whole a well informed review of the subject, is not quite up to date.

The "universal" feature (*i.e.*, the similarity of performance on d.c. and a.c.) depends on the speed. In a machine of, say, 1/6th h.p. at 9,000 r.p.m., the full load performances under the two conditions can be made almost identical without the necessity for field tappings. As many applications for this type of machine, *e.g.*, vacuum cleaners, hair dryers, drills, are suitable for high-speed motors, no trouble is experienced.

On the question of the repulsion-start induction motor *versus* the split-phase motor, Mr. Philpott also is not entirely accurate. It is quite true that a high starting torque can be obtained, but the correct practice should be to design for not more than twice-full-load current at start, at which the torque should be three to four times that at full load. The main drawback to this type of machine is its cost, and the impossibility of making a machine of comparable full-load performance having the same dimensions as a split-phase motor. It is equally true that, in the past, split-phase motors would only run up to speed against 30 to 40 per cent. of full-load torque and had practically no overload capacity. This, however, is not the case to-day. One of the largest manufacturers in this country can offer split-phase motors which will develop full load torque, and *maintain it* up to full speed. The same machines (¼ h.p.) have 100 per cent. overload capacity and a high efficiency (62 per cent.).

Very few applications require more than full-load running-up torque. The trouble with split-phase motors of the old design was that they would not maintain their static torque. They would invariably start, but, against load, they would crawl instead of rising to full speed.

Now that this objection has been overcome, the split-phase motor will perhaps be better able to compete against the repulsion-start machine, except in cases where starting current is of vital importance, and such cases, incidentally, are very few. N. F. T. SAUNDERS.

Birmingham, *August 18th*, 1931.

We have noticed in your correspondence columns recently the controversy that has been taking place in connection with the starting torque of repulsion-induction motors.

In an article on miniature electric motors by Mr. Stuart F. Philpott, in your issue of August 14th, the author, in dealing with the methods of starting different types of motors, states in regard to the split-phase design: "Split-phase starting motors are very popular, but make a poor performance; they have a small starting torque (30 to 40 per cent. of full load), take a heavy starting current (four to five times full load) and have little overload capacity. They are large for their output, and are complicated by the necessity of the centrifugal switch."

We wish to say that we cannot agree at all with Mr. Philpott's remarks. There are to our knowledge at least four or five makers of split-phase motors, included amongst which are three of British manufacture, which have starting torques of at least 100 per cent., some 150 per cent., and some 200 per cent. of full load, for a starting current of four to five times full load; moreover, these motors are, in comparison with any other form of a.c. motor of similar power and speed, extraordinarily compact. We are somewhat surprised that Mr. Philpott should have made such a statement, and think it most misleading.

M. W. WOODS, LTD.,
M. Geoffrey Woods,
London, W.C.2, *August 19th*, 1931. *Director.*

The Segmental-strand Conductor

We write to point out that in an article in your last issue on "The Segmental-strand Conductor" a statement is made that their manufacture is confined to one particular firm. This is incorrect.

Many years ago this company held patents for the use of segmental-strand cables, but these patents have long since expired, and to-day anyone is free to make conductors of this type. To my own knowledge they have been manufactured at Prescot in large quantities ever since the year 1894.

BRITISH INSULATED CABLES, LTD.
G. H. Nisbett,
Prescot, *August 22nd*, 1931. *Managing Director.*

[Segmental-strand conductors have been manufactured for cables for many years, but we are informed that the application of this type of conductor to overhead-line construction in the manner described in our article is covered by recent patents.—EDS. ELEC. REV.]

The American I.E.S.

The 25th Annual Convention of the Illuminating Engineering Society (U.S.A.) will be held in Pittsburgh from October 12th to 16th. The part which fog plays in the safety of air travel is recognised by the Society, which proposes to devote an entire session to the discussion of aviation lighting, including the lighting of airports, airways, and aeroplanes, and the transmission of light through fog.

Other subjects to be dealt with include the sale of electricity, the merchandising of electrical equipment, home lighting, safe industrial lighting, and general lighting practice.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1929

23,441. "Microphones for use in the production of sound films." T. T. Baker. April 29th, 1930. (353,887.)

1930

3,084. "Protecting devices for electric circuits." Edison Swan Electric Co., Ltd., G. F. Shotter and E. Greetham. January 29th, 1930. (353,924.)

6,031. "Devices for heating electric hand irons." Akt.-Ges. Brown, Boveri et Cie. February 22nd, 1929. (353,912.)

9,248. "Regulators for dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. Taylor. March 22nd, 1930. (353,893.)

12,696. "Electric terminals." British Thomson-Houston Co., Ltd. April 24th, 1929. (353,933.)

13,032. "Eddy-current brakes." E. R. & F. Turner and F. H. Johnson. April 28th, 1930. (353,880.)

13,076. "Systems of television." H. Spindler. April 29th, 1929. (353,884.)

13,191. "Electron-discharge tubes or thermionic valves." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 25th, 1929. (353,905.)

13,200. "Multi-channel or multiplex high-frequency signalling systems." Marconi's Wireless Telegraph Co., Ltd., and G. A. Mathieu and O. S. Puckle. April 29th, 1930. (353,906.)

13,210. "Telephone systems." Siemens & Halske Akt.-Ges. April 29th, 1929. (353,907.)

13,217. "Electrical roasting and baking ovens." Maxim Soc. Anon. Fabrique d'Appareils Thermo-Electriques and H. Hofer. April 30th, 1929. (353,909.)

13,467. "Wireless telegraph transmitters." Siemens Bros. and Co., Ltd., and M. Reed. May 1st, 1930. (353,955.)

13,905. "Photo-electric cells." Westinghouse Lamp Co. May 6th, 1929. (353,554.)

13,950. "Telephone Systems." Automatic Telephone Manufacturing Co., Ltd., and W. Saville. May 6th, 1930. (353,957.)

14,562. "Electric order telegraphs and like instruments." Evershed & Vignoles, Ltd., and J. C. Needham. May 12th, 1930. (353,965.)

14,732. "Luminous electric discharge tubes." General Electric Co., Ltd., and J. W. Ryde. May 13th, 1930. (353,967.)

14,744. "Electrical regulators." British Thomson-Houston Co., Ltd., H. W. Taylor, C. Stewart and R. D. Parry. May 13th, 1930. (353,968.)

14,757. "Wireless receiving systems." Gramophone Co., Ltd., and A. H. Cooper. May 13th, 1930. (353,969.)

14,983. "Bases for electric incandescent lamps and similar devices." British Thomson-Houston Co., Ltd. May 15th, 1929. (353,973.)

15,912. "Photo-electric cells." Westinghouse Lamp Co. June 12th, 1929. (353,981.)

16,761. "Automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. May 30th, 1930. (353,989.)

17,825. "Pressure-relief devices for electric switches of the fluid-break type." British Thomson-Houston Co., Ltd. June 10th, 1929. (Addition to 293,776.) (353,997.)

18,219. "Electric indicator of direction and force of the wind." A. V. Leuchovius. June 13th, 1930. (354,000.)

18,533. "Electrical filters." Marconi's Wireless Telegraph Co., Ltd. September 28th, 1929. (354,005.)

18,627. "Distant control of apparatus driven by electric motors." Rheinische Metallwaarenund Maschinenfabrik and H. Sundhaussen. June 18th, 1930. (354,007.)

18,959. "Ignition-control apparatus." R. Bosch Akt.-Ges. June 29th, 1929. (354,010.)

19,258. "Electrically-controlled braking devices." G. W. Kellner. June 24th, 1930. (354,013.)

19,405. "Sound-reproducing apparatus relating to loud-speakers and the like." A. J. L. Haynes. June 25th, 1929. (354,014.)

19,989. "Electro-thermally-operated electric vacuum switches." Scherbius & Ritter. July 1st, 1929. (354,020.)

20,420. "Connecting device for use with stranded metal cables." British Insulated Cables, Ltd., and J. W. Astley. July 5th, 1930. (354,025.)

21,029. "Electric switches." L. H. Reid. July 11th, 1930. (354,031.)

21,108. "Carrier-wave television systems." Gramophone Co., Ltd., and W. J. Brown. July 11th, 1930. (354,032.)

21,370. "Telemotor apparatus." W. J. Paulin and T. C. Fortune. July 15th, 1930. (354,033.)

21,870. "Traffic-control apparatus." Chance Bros. & Co., Ltd., and J. H. Abbink-Spaink. July 19th, 1930. (Cognate application 33,121/30.) (354,036.)

21,903. "Electric candle-lamps." M. Solomon and F. Winstanley. July 19th, 1930. (354,037.)

22,086. "Electric switchgear." Metropolitan Electric Supply Co., Ltd., H. Lloyd-Williams and L. J. Swan. July 22nd, 1930. (354,039.)

22,244. "Power transmission by electro-magnetic means." J. Murphy and J. Brennan, Junr. July 23rd, 1930. (354,040.)

22,316. "Telephone systems." Coventry Automatic Telephones, Ltd., and J. A. Tweats. July 24th, 1930. (354,043.)

22,794. "Movement for time switches." Landis & Gyr Soc. Anon. July 31st, 1929. (354,046.)

22,908. "Pivotal mounting of the operating levers of multiple electric switches." J. B. Tucker. July 30th, 1930. (354,047.)

22,996. "Electron-discharge devices." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 1st, 1930. (354,048.)

23,237. "Fusible electric cut-outs." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. August 1st, 1930. (354,049.)

23,606. "Electric horn or sound-producing device." P. Haasis. August 6th, 1930. (354,057.)

23,711. "Electron valves." Telefunken Ges. für Drahtlose Telegraphie. September 9th, 1929. (354,059.)

25,876. "Submersible electric motors." M. Surjaninoff. September 3rd, 1929. (354,074.)

25,903. "High-frequency oscillation generators." Telefunken Ges. für Drahtlose Telegraphie. September 9th, 1929. (354,075.)

26,413. "Ignition magnetos." Fabrica Italiana Magneti Marelli. September 5th, 1929. (354,080.)

26,458. "Sealing of conductors into electrical apparatus." British Thomson-Houston Co., Ltd. September 4th, 1929. (354,082.)

26,601. "Method of inserting pole shoes in ignition magnetos." Fabrica Italiana Magneti Marelli. September 6th, 1929. (354,085.)

27,050. "Portable electric lamps." H. Wiesmeyer. September 11th, 1929. (354,092.)

27,265. "Machine for filling and cooking electric dry batteries." H. A. Bumke Ges. October 25th, 1929. (354,094.)

28,432. "Radio coils." Sparks-Withington Co. October 30th, 1929. (354,104.)

30,778. "Socket for mounting radio valves and the like." G. E. Gobin-Daude. August 1st, 1930. (354,113.)

31,098. "Electrically-operated devices for driving advertising, display and the like apparatus." C. M. McGhee, and W. V. Gilligan. October 17th, 1930. (354,115.)

31,559. "Electronic oscillators." British Thomson-Houston Co., Ltd. October 23rd, 1929. (354,120.)

32,121. "Remote-control devices for radio receivers." Kolster-Brandes, Ltd. (Kolster Radio Corporation). October 25th, 1930. (Convention date not granted.) (354,124.)

32,885. "Contacts for electric switches and other apparatus." A. P. Lundberg & Sons, Ltd., and G. Pegg. November 1st, 1930. (354,127.)

33,192. "Devices for rectifying three-phase alternating currents." C. H. F. Muller Akt.-Ges. November 4th, 1929. (354,128.)

35,873. "Electric gas or vapour filled arc-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 9th, 1930. (354,141.)

36,739. "Metallic container for electric accumulators intended to operate in an inflammable atmosphere." Forges and Ateliers de Constructions Electriques de Jeumont. January 13th, 1930. (354,146.)

37,579. "Supporting device for driving units of loud-speakers." Ideal Werke Akt.-Ges. für Drahlose Telephonie. May 13th, 1930. (354,148.)

1931

2,781. "Electric motor controllers." E. H. Laabs. February 8th, 1930. (354,155.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 19th:—

Parlorvac. No. 522,172. Class 6. Electric vacuum cleaning machines.—Markt Co. (London), Ltd., Portpool Lane, Gray's Inn Road, E.C.1.

Columbia. No. 519,113. Class 8. Radio-receiving sets, gramophones in combination with radio-receiving sets, and parts thereof.—Columbia Graphophone Co., Ltd., 102-108 Clerkenwell Road, E.C.1.

K.L.G. (lettering and design). No. 522,845. Class 13. Sparking plugs and parts thereof.—K.L.G. Sparking Plugs, Ltd., Robinhood Engineering Works, Putney Vale, S.W.15.

Sunspot. No. 523,638. Class 13. Electric lamps (ordinary). —Nivalight (1928), Ltd., 1, Rosebery Avenue, E.C.1.

Batterium. No. 523,909. Class 13. Metal goods.—Batterium Metals and Vislok, Ltd., 3, St. Bride's House, Salisbury Square, E.C.4.

Gly. No. 524,162. Class 18. Heating appliances for buildings.—English Electric Co., Ltd., Queen's House, 28, Kingsway, W.C.2.

Normandite. No. 524,056. Class 40. Electrical insulating material made of india-rubber.—Hightensite (1930), Ltd., Normandy Street, Custom House, E.16.

Report of Secretary for Mines

The tenth annual report of the Secretary for Mines, with which is incorporated the annual report for 1930 of H.M. Chief Inspector of Mines under the Coal Mines Act, 1911, has now been published. The report contains a general review of the coal-mining industry and of other mining and quarrying industries, including a descriptive account of the Coal Mines Act, 1930. Part 2 deals, *inter alia*, with the initiation of some fresh developments of general safety policy, the formulation of proposals to secure improved lighting at mines, and the steps taken for dealing with harmful concentrations of dust resulting chiefly from the use of mechanical drills. The report on other mining and quarrying industries deals with the production and distribution of a wide variety of minerals upon which the metallurgical, building, road making, &c., china, pottery and glass and the chemical industries are dependent. The report of the Chief Inspector of Mines reviews statistically the mining accidents of the year, and discusses generally the progress made in preventive measures, and the need for further progress, and the lines along which it can be made. The report may be obtained from H.M. Stationery Office; price 3s. 6d., or 3s. 9½d. by post.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldershot.—Houses (24), for the T.C.; borough surveyor.
Axminster.—Houses (24), for the U.D.C. (£9,104).
Bath.—Alteration to premises, Queen Square; I. F. Amery and Sons, builders, 21, Grove Street.
Belvedere (KENT).—Factory for the International Match Corporation of Great Britain, Ltd.
Bideford.—Houses (36), Sentry Corner, for the T.C.
Birchington-on-Sea (KENT).—Mission church of St. Thomas, Minnis Bay; vicar.
Birmingham.—Church, Perry Common Road; R.C. authorities.
Bolton.—Alterations to Lincoln Mill, including new entrance, for Messrs. Robert Entwisle & Co., Ltd., Washington Street; William Townson & Co., Ltd., builders, Park Hill Street.
Bridgwater.—Houses (75), Corporation estate; Samson and Colthurst, architects.
Bridlington (YORKS.).—Houses (50), for the T.C.; borough surveyor.
Bristol.—Shops, Old Market Street; F. Wilkins, builder, 24, Temple Back.
Bursiem.—Development of Wood Farm estate; Challerley-Whitfield Colliery Co., Ltd.
Cambridgeshire.—School (240 places), Chatteris, Isle of Ely, for the county E.C.; E. J. P. Osborne, director of education, March.
Cheshire.—New wing, Parkside Mental Hospital (100 patients) (£16,000); H. Kelly, Cheshire County Mental Hospital, Parkside, Macclesfield.
Chesterton (CAMBS.).—Houses (68), Histon, for the R.D.C.; W. Elson, clerk, 12, St. John's Street, Cambridge.
Chorley.—Development of building estate, Harpers Lane; S. Widdows.
Clun (SALOP).—Houses (28), for the R.D.C.; H. A. Elliott, surveyor, Bishop's Castle.
Coatbridge.—Rehousing scheme, Bank Street; borough engineer.
Cumberland.—Extensions, Grammar school, Penrith, and reconstruction of the Council school, Scaleby, for the C.C.; Mr. Stockdale, county architect, Carlisle.
Devonshire.—Senior school at Plympton, for the county E.C.; county architect, 97, Heavitree Road, Exeter.
Edinburgh.—Houses (46), Niddrie Mains; city architect
Ely (CAMBS.).—Houses (58), for the U.D.C.; surveyor.
Falmouth.—Houses (40), Penwerris; H. E. Tresidder, borough surveyor.
Fife.—Electric lighting work, extensions to Kirkcaldy West school, for the C.C.; George Sandilands, architect, Education Offices, Wemyssfield.
Glasgow.—Houses (210), High Craighill, Scotstoun area and Springburn estate; housing director and trade contractors. Extension to the Adelphi Hotel, 170, Argyle Street; I. Taylor, architect, 220, West Regent Street. Building works at Lennox Castle (£48,149); John Train & Co. (Glasgow), Ltd. Church, St. John's Road, Cathcart; Cathcart U.F. Church trustees. Alterations and additions to the Wellington Mills of E. MacBean and Co., Ltd., 123, Howard Street; Wylie, Wright & Wylie, architects, 204, West Regent Street.
Gloucestershire.—School, Double View, East Dean (£10,000), for the county E.C.; director of education, Gloucester.
Goole.—All Saints' church; Jackson & Oates, builders.
Gosport.—Houses (142), Privett estate; borough engineer.
Hanley.—Houses (122), Holden Farm estate; Shenton Bros.
Hertfordshire.—Laundry extensions, Barnet Institution, for the C.C.; A. Saxon Snell & Phillis, architects, 9, Bentinck Street, Manchester Square, London, W.
High Wycombe.—Alterations and improvements to the premises of A. Leadbetter, 3, High Street; T. Thurlow, architect, 25, High Street.
Hove.—Houses (100), Old Shoreham Road; H. O. Jones, borough engineer.
Huddersfield.—Extensions, Royds Hall school (£12,000), for the borough E.C.; director of education.
Hull.—Baths (£19,279), for the T.C.; R. Cleminshaw, contractor. Branch library, Newland; city architect. Extension of Royal Station Hotel for London & North Eastern Railway.
Inverness.—Houses (74), for the T.C.; burgh surveyor. Baptist church (£3,500); Stewart & Paterson, architects, Glasgow.
Irish Free State.—(BALDOYLE, DUBLIN).—Additions to St. Patrick's schools, for Christian Brothers; Foley & O'Sullivan, architects, 103, Grafton Street. (DUN LAOGHAIRE).—Extensive housing scheme; P. J. Hexnon, borough manager.
Kingsbridge.—Houses (22), at Wallingford, for the U.D.C.
Kingston-on-Thames.—Houses (40); borough engineer.
Lancashire.—Extensions, Billinge, Seaforth and Darwen police stations (£6,150); county engineer. School, Tyldesley (£27,000) and extension to Minor Street, Failsworth school (£14,878), for the county E.C.
Leeds (YORKS.).—Extensions to drapery stores for Bridges and Co., Ltd., Briggate, Lands Lane, and Thornton's Arcade. Elementary school, Middleton (£42,000); city architect.
Lexden (ESSEX).—Congregational church; John Harrison and Co., builders, Camberwell, S. E.
Lincolnshire.—School, Boston (£20,000), and science wing, Spalding Grammar school (£7,000), for Holland E.C.; J. H. McKnight, director of education, Spalding.
London.—(ELTHAM).—Elementary school, Montbello Road; L.C.C. architect. (HIGHAMS PARK).—Telephone exchange, for H.M. Office of Works, King Charles Street, S.W. (SOUTHWARK).—Tenements, Sumner Street (£30,000); Walter Lawrence and Sons, Ltd. (WEST HAM).—Extensions, Goodmayes Mental Hospital, for the T.C.; borough engineer. Electric light installation, Southallsville, Cheshunt Road, and Pretoria Road schools, for the borough E.C.; J. H. Jacques, architect, 61, West Ham Lane, Stratford, E.
Longton.—Rehousing scheme, John Street area; Stoke-on-Trent, city engineer.
Malton (YORKS.).—Houses (50), for the R.D.C.; W. M. Jackson, architect.
Manchester.—Extensions to the premises of Affleck & Brawn, Ltd., Oldham Street; J. W. Beaumont & Sons, architects, 24, Brazenose Street. Rebuilding premises for Messrs. Tuthills, Ltd., 7, Swan Street; T. A. Fitton & Son, architects, 19a, Corporation Street.
Merthyr Tydfil.—Power house, general hospital; D. Charles Davies, architect, 112, High Street.
Middlesex.—Elementary school, Chalfont Avenue, Wembley, for the county E.C. Maternity accommodation (160 patients), North Middlesex Hospital, and extension of county school at Greenacre House; county architect.
Morecambe.—Rebuilding of premises for the Morecambe Press, Ltd., Union Street; Hillman & Sons, builders, Euston Road.
Newcastle-on-Tyne.—Radium institute for the British Empire Cancer Campaign. Alterations to the head post office; J. T. Main, builder, Elswick Road. School, Two Ball Lonnen (1,500 places), for the E.C.; Mr. Walling, director of education, Town Hall. Additions and alterations to St. Robert's Church, Fenham; R. Howard, builder, Grange Road.
Newton Stewart (AYRSHIRE).—Housing scheme, for the T.C.; burgh surveyor.
North Riding.—Schools at Hurworth Without and Eston, for the C.C.; county architect, Northallerton.
North Shields.—Extensions to premises of Messrs. Lewis's, Bedford Street; W. Stockdale, architect, 13, Howard Street. Rebuilding of the Wesley Church (£3,000); Marshall & Tweedy, architects, 129, Pilgrim Street, Newcastle-on-Tyne.
Northumberland.—School, East Chevington (£7,446); G. Towers, builder, Blyth. Remodelling Berwick Bell Tower school, Berwick-on-Tweed, for the C.C. (£10,546); J. G. Green, builder, Warkworth.
Oldham.—Mission church, St. Barnabas', for the Parochial Council; Lord & Milner, builders, Pernham Street.
Paignton.—Houses (24), for the U.D.C.
Pelaw-on-Tyne.—Stores for the C.W.S.; C.W.S. Building department, builders, Blandford Street, Newcastle-on-Tyne.
Pontefract.—Houses (130), Baghull Lane; Tennant & Smith, architects, Ropergate Chambers. Church, with electrical work for heating and lighting; Horner & Sons, builders.
Preston.—County office, extensions (£86,932), for the Lancs. C.C.; W. Knowles, Ltd., Darwen.
Reading.—Sports stadium for Reading Stadium, Ltd.; Major James McEnnery, secretary, 172, Friar Street.
Richmond (YORKS.).—Isolation hospital, for the T.C.; J. W. Trodd, borough engineer, Frenchgate. Houses (110), for the R.D.C.; council surveyor.
Rochdale.—Houses (32), for firemen and superintendents' house, Richard Street and Maclure Road site, for the T.C.; R. & T. Howarth, Ltd., builders, Crossfield Works. Maternity hospital, &c., Birch Hill; borough surveyor.
Royston (HERTS.).—Town Hall extensions, with electrical work, for the U.D.C.; Gimpson & Co., contractors.
Rugeley (STAFFS.).—Houses (30), for the U.D.C.; surveyor.
Sevenoaks.—Houses (52), Millpond Wood site, for the U.D.C.; surveyor. Houses (42), for A. J. Clear, Hillingdon Avenue building estate.
Southend-on-Sea.—Business stores, Southchurch Road and Essex Street, for the Co-operative Society; secretary.
South Shields.—Houses (50), West Park; J. P. Watson, borough engineer.
Staffordshire.—Schools, Coton, Milwich, for the county E.C.; director of education, Stafford.
Stafford.—Church of Our Lady of Lourdes, Hednesford; Lowe and Sons, builders, Curzon Street, Burton-on-Trent.
Steyning (SUSSEX).—Houses (59), Downlands estate, Sompting, for Mrs. Hasler.
Stirling.—Bank extensions, with shops, Murray Place and Friars Street, for the Commercial Bank of Scotland, Ltd., Edinburgh.
Stoke-on-Trent.—Elementary school, Meir, for the E.C.
Stretford (MANCHESTER).—Municipal buildings (£120,000), for the U.D.C.; surveyor.
Trentham (STAFFS.).—Development, New Park estate; Watkin and Adams, architects.
Truro.—Houses (50), Hendra estate (£19,191); T. Rundall, builder.
Tynemouth.—Infectious diseases hospital, for the T.C. (£19,400); J. L. Beckett, borough engineer, Howard Street, North Shields.
Wakefield.—Houses (23), Brunswick Street (£6,000), and New Street area; housing architect. Works extension, Denby Dale Road; Spencer Wire Co., Ltd.
Warrington.—Extensions to the premises of Messrs. Bennitt's Derby Confectionery Works, Lovely Lane; W. & A. Ashton, builders, Bridge Foot. Stores, Sankey Street; Co-operative Wholesale Society, Ltd., Manchester.
West Hartlepool.—School at Throston, for the E.C.; J. H. Miers, borough engineer.
West Riding.—Extensions to the Public Assistance Institution, Wakefield, for the C.C.; O. Platt, County Hall, Wakefield. Senior school, Skelmanthorpe (£22,500), and alterations to Council School, Featherstone (£1,850); county architect, Wakefield.
Wednesbury.—Reconstruction of the Wesleyan church; A. Blocklehurst, architect, 10, Norfolk Street, Manchester.
Whitchurch.—Houses (58), U.D.C. estate; M. W. Sowden, architect.
Wigan (LANCS.).—Extensions, Billinge Hospital, including nurses' hostel (£14,870), for the Public Assistance Committee; W. H. Tyrer, town clerk.
Willington (DURHAM).—Extensions to Wesleyan church; J. H. Amory, contractor.